@BRINTBusinessResearchAdaptecAdobe
AdvertisingLawIternetSiteAladinAlbanyNet
AltaVistaUseNetAltaVistaWebAmazon.com
BookSearchAmericanMemoryCollectionSe
archAmerica'sJobBankSearchIndexAOLNe
tFindAppleComputerAquaLinkArchNetArc
haeologyAskSherlockHousingSearchAT&T
800DirectoryAutoWebInteractiveBellnet.co
mBigFootBizWebBorlandBytec|netcdcomc|
etSearch.ComCareerCityCareerMosaicJOB
SCBSSportslineCNNDatabaseCNNfnthefin
ancialnetworkCollegeNetCommunicationsL
awCompaqGamingWorldComputerNewsDa
ilyCorelCreativeLabsCyberiderCyclingWW
WSiteDATAMANSunManagersDBCOnlinest
ockquotesDBIUsersArchiveDejaNewsDisco
veryChannelOnlineSearchDisney.comsear
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oreFrontForumOneOnlineDiscussionForu
msGalaxyGolfcourse.comCourseLocatorG
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NOAAOceansandAtmosphereDatabaseNok
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esOpenTextOrientation.comAsiaOSHAPan
asonicPCWorldOnlinePlanetSearchPoint's
Top5%PolaroidPrincetonReviewProductRe
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QVC/iQVCShopProductSearchRec.Skydivi
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oimageSurferYahooligansYellowPagesOnli
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Search Tutorial:

Guide to Effective Searching of the Internet

May 1998

The WebTools Company

Thanks and Acknowledgements

Thanks for taking the time to learn more about how to effectively use the Internet. We hope sincerely this tutorial helps speed you along the path to better information.

We prepared this tutorial because of our own frustrations in finding a central resource having to do with all things “searching.” We know we’ve missed much of value on the Internet on these subjects, though we’ve tried our darnedest to find all we could. Our apologies to other “power searchers” out there whose valuable work we’ve inadvertently overlooked.

This tutorial was prepared by Michael Bergman of The WebTools Company, with the super assistance of TWTC technical staff including Carol Lushbough, Tom Tiahrt, Jerry Tardif, Al Margheim, Will Bushee and Doug Corwin. The authors have attempted to be as accurate and fair as possible; we welcome your suggestions for improvements or informing of us of errors. Please submit all comments to: tutorial@thewebtools.com.

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Search Tutorial: Guide to Effective Searching on the Internet

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Search Tutorial: Guide to Effective Searching on the Internet

Looking for that perfect condo for your ski trip? Needing specifications for a manufacturer's particular piece of equipment? Want discussion and commentary on your favorite, but obscure, author? Trying to find out what your competitors are up to? Seeking recent studies on planets in other solar systems? Needing information on special scholarships for which you might be qualified?

These, and millions of queries covering every conceivable topic, are now being posed daily to the Internet's search services. With anywhere from 200 million to 300 million or more publicly available documents – an amount remarkably doubling every 6 to 12 months – the Internet has become a vast, global storehouse of information. The only problem is: how do you find what you're looking for?

Unfortunately, there is no Dewey decimal system or central "card catalog" for the Internet. You must use a search service to find new information. Search services come in one of two main flavors. Each has its place, depending on your information needs.

'Directories' use trained professionals to classify useful Web sites into a hierarchical, subject-based structure. Yahoo is the best known and most used of these services. Directories are most useful when looking for information in clear categories, such as makers of yoghurt or listings of educational institutions. Each directory uses its own categories and means to screen useful sites and assign them to a single category.

'Search engines' work differently. Excite, AltaVista and Infoseek are some of the best known engines. They "index" (record by word) each word within all or parts of documents. When you pose a query to a search engine, it matches your query words versus the records it has in its databases to present a listing of possible documents meeting your request. Search engines are best for searches in more difficult topic areas or which fall into the gray areas between the subject classifications used by directories. But, search engines are stupid, and can only give you what you ask for. You can sometimes get thousands (millions!) of documents matching a query. Also, at best, even the biggest search engines only index one third to one half of the Internet's public documents.

So, while three quarters of users cite finding information as their most important use of the Internet, that same percentage also cite their inability to find the information they want as their biggest frustration. The purpose of this tutorial is to help you end that frustration.

Your ability to find the information you seek on the Internet is a function of how precise your queries are and how effectively you use search services. Poor queries return poor results; good queries return great results. Contrary to the hype surrounding "intelligent agents" and "artificial intelligence," the fact remains that search results are only as good as the query you pose and how you search. There is no silver bullet.

Internet searchers, perhaps including you, tend to use only one or two words in a query. Big mistake! Also, there are very effective ways to "structure" a query and use special operators to target the results you seek. Absent these techniques, you will spend endless hours looking at useless documents that do not contain the information you want. Or you will give up in frustration after search-click-download-reviewing long lists of documents before you find what you want.

All of us need information. But few of us have studied information or library science, and not everyone has used search services or Internet search engines sufficiently to learn all of the nuances. This tutorial is for those who are learning the ropes about ‘power searching.’ But, even if you’re quite experienced in these areas, you might find some benefit from glancing through these topics.

This tutorial is organized to proceed from the basics to more advanced topics. It has 12 parts containing 48 topics. The first part on the next page gives a quick bottom-line summary.

Simple to follow examples are presented in each topic. We’ve written it to be a one-stop reference. Don’t feel you need to work through all of the topics in one sitting. But, if you do take the time to work through this material, we guarantee you’ll reap big dividends in faster and more accurate results. And, you will be on your way to earning the title of an Internet “Power Searcher.”

Documentation is appended at the end **[1,2]**.

Part 1: The Two-Minute Bottom Line

To illustrate some of the basic concepts and recommendations covered in this tutorial, let's say we have an interest in recent findings about new planets being discovered outside our solar system. Using the information "contained" in this statement, you can see how an effective query can be built by following these guidelines.

We'll summarize the recommendation, show how the statement is phrased, describe why it's important, and provide a pointer to the specific topic number in the tutorial that covers this recommendation. See the table of contents for relating topic numbers to subject titles.

Recommendation	Example	Why Important?	Topic #
1. Use nouns and objects as query keywords	**planet** or **planets**	Actions (verbs), modifiers (adjectives, adverbs, predicate subjects), and conjunctions are either "thrown away" by the search engines or too variable to be useful	**6**, **7**, **8**
2. Use 6 to 8 keywords in query	**new**, **planet**, **planets**, **discovery**, **solar**, **system**	More keywords, chosen at the appropriate "level", can reduce the universe of possible documents returned by 99% or more	**8**,**10**
3. Truncate words to pick up singular and plural versions	**planet*** or **discover***	Use asterisk wildcard. The wildcard tells the search engine to match all characters after it, preserving keyword slots and increasing coverage by 50% or more	**9, 48**
4. Use synonyms via the **OR** operator	**discover* OR find**	Cover the likely different ways a concept can be described; generally avoid **OR** in other cases	**11, 48**
5. Combine keywords into phrases where possible	**"solar system*"**	Use quotes to denote phrases. Phrases restrict results to EXACT matches; if combining terms is a natural marriage, narrows and targets results by many times	**12**
6. Combine 2 to 3 "concepts" in query	**"solar system"** **"new planet*"** **discover* OR find**	Triangulating on multiple query concepts narrows and targets results, generally by more than 100-to-1	**20**
7. Distinguish "concepts" with parentheses	**("solar system")** **("new planet*")** **(discover* OR find)**	Nest single query "concepts" with parentheses. (Overkill for now, but good practice when first learning.) Simple way to ensure the search engines evaluate your query in the way you want, from left to right	**19**
8. Order "concepts" with subject first	**("new planet*")** **(discover* OR find)** **("solar system")**	Put main subject first. Engines tend to rank documents more highly that match first terms or phrases evaluated	**7**, **19**, **20**

Recommendation	Example	Why Important?	Topic #
9. Link “concepts” with the **AND** operator	**(“new planet*”) AND (discover* OR find) AND (“solar system”)**	**AND** glues the query together. The resulting query is not overly complicated nor nested, and proper left-to-right evaluation order is ensured	**14**, **20, 48**
10. Issue query to full “Boolean” search engine or metasearcher	As above	Full-Boolean engines give you this control; metasearchers increase Web coverage by 3- to 4-fold	**3**, **35**, **36**, **38, 48**

By issuing the query in **#9** above to AltaVista, we are able to restrict results from a baseline of 418,934 documents using the query **new AND planet** (actually 551,936 if we were to properly include **planets** as well) to a count of 934 documents **[1].** Though that number still seems like a lot, we have reduced our possible universe of results by 400 to 600 times, and three of the first five documents listed give us exactly what we were looking for:

http://www.got.net/~seasons/new.html
http://www.ucar.edu/quarterly/summer97/planet.html
http://www.packer.edu/Access/Internal/Students/Astronomy/New_Planets.html

Go ahead; try these queries for yourself!

The ultimate bottom line to getting the best results for your queries is to search multiple services simultaneously using a universal format. Our solution is to provide you full Internet searching power at your desktop via the **Mata Hari™** product **[Topic 48]**.

Do you want to be able to get such impressive results for your own queries? Then, welcome. It’s now time to start the tutorial.

Part 2: Internet Search Basics and Why There's a Problem

Much is discussed on the Internet regarding its growth and user-driven, decentralized nature. This part overviews the current state of searching and search services on the Internet. The essential arguments are that your time is well spent learning how to issue more effective queries and to understand the basic operations of the search services you employ.

Topic 1: Status of the Internet and Searcher's Frustrations

Many have likened the Internet to a huge, global library. While true in some aspects, it has some unique differences. There is no central "card catalog"; the Internet's growth is outpacing the ability of humans or technology to keep up with it; its sheer size is unknown and perhaps unknowable; and content is (to say the least) of uneven quality.

Here's some of what we know (or think we know) about information on the Internet:

- There are from 200 million to more than 320 million documents publicly available on the Internet **[3,34]**
- Document growth is, at minimum, doubling each year **[4]**
- Two-thirds to three-quarters of all users cite finding information as one of their primary uses of the Internet **[5]**
- Two-thirds to three-quarters of all users cite the inability to find the information they seek as one of their primary frustrations (second only in frustration to slowness of response) **[6]**
- Of the major search engines, estimated coverage of the documents on the Internet ranges from a high of 34% to a low of 3% **[3]**
- Combining multiple search engines in a given search can increase the likelihood of finding the information desired by a factor of 3.5 or more **[3]**
- Different search formats and conventions make it difficult to search multiple engines at one time
- Use of structured, or 'Boolean' queries, while known to help obtain better search results, can be difficult and frustrating for some users to learn.

One of the challenges of the Internet is to make its value available to the millions of new users who have had no formal training or experience in query formulation or search strategies.

Topic 2: Search Engine and Directory Basics

The major search services on the Internet are essential starting points for users seeking information. As such, they routinely are some of the most visited locations on the Web.

Search services can be divided into two groups, commercial and non-commercial. Commercial search services go to the effort to catalog information on the Internet to attract attention and advertising revenues. Non-commercial services exist for many different reasons.

There are more than 1,000 search services presently on the Web **[7]**. There are a dozen or more big, major Internet search services (listing is not an endorsement nor based on a financial relationship):

- AltaVista [http://www.altavista.digital.com]
- Excite [http://www.excite.com]

- LookSmart [http://www.looksmart.com]
- Hotbot [http://www.hotbot.com]
- Infoseek [http://www.infoseek.com]
- Lycos [http://www.lycos.com]
- Magellan [http://www.mckinley.com]
- Mining Company [http://home.miningco.com]
- NetFind (AOL) [http://www.aol.com]
- Northern Light [http://www.nlsearch.com]
- WebCrawler [http://www.WebCrawler.com]
- Yahoo [http://www.yahoo.com]

There are also ‘metasearch’ services that provide a central access point to multiple of these services. Notable names – again, not suggesting endorsement – are:

- Metacrawler [http://www.metacrawler.com]
- Inference FIND [http://www.inference.com/infind/]
- SavvySearch [http://guaraldi.cs.colostate.edu:2000]

Search services on the Internet come in two main flavors: 1) ‘search engines’ that index words or terms in Internet documents; and 2) ‘directories’ that classify Web documents or locations into an arbitrary subject classification scheme or taxonomy. Most of the above are examples of the former; Yahoo, Mining Company and LookSmart are examples of the latter.

Search engines use ‘spiders’ or ‘robots’ to go out and retrieve individual Web pages or documents, either because they’ve found them themselves, or because the Web site has asked to be listed. Search engines tend to “index” (record by word) all of the terms on a given Web document. Or they may index all of the terms within the first few sentences, the Web site title, or the document’s metatags **[8]**. Due to the ever-changing nature of the internet, the services must re-sample their sites on a periodic basis. Some of these services re-sample their sites on a weekly or less-frequent basis.

Precision, *recall* and *coverage* are limiting factors for most search engines. Precision measures how well the retrieved documents match the query; recall measures what fraction of relevant documents are retrieved **[27]**. Coverage refers to what percentage of the potential universe of relevant documents is cataloged by the engine. For example, consider a search engine with 10 documents, five of which mention eagles, out of a total universe of 50 potential documents mentioning eagle (45 of which are not indexed by that engine). A query on eagle that returned four documents and two others from this engine would have a precision of 0.66, a recall of 0.80 and coverage of 0.10.

Precision is a problem because of the high incidence of false positives. (That is why you get so many seemingly irrelevant documents in your searches.) This is due to imprecision in the query (searching on eagle and missing the mention of eagles), indexing mistakes by the engine, and keywords entered by the Web document developer that do not actually appear in the document. Coverage is a problem for all engines, with the largest ones only covering at most one third to one half of publicly-available documents **[3,34]**.

Search directories operate on a different principle. They require people to view the individual Web site and determine its placement into a subject classification scheme or taxonomy. Once done, certain keywords associated with those sites can be used for searching the directory's data banks to find Web sites of interest.

These distinctions by search service are not clean in all cases. The Excite search engine, for example, uses 'morphological analysis' for determining its keyword matches **[3]**. While construction of the index is more akin to a search engine, in operation Excite can work like a directory. As other search engines begin classifying information into directory-like clusters, these distinctions are likely to continue to get fuzzier.

For searches that are easily classified, such as vendors of sunglasses, the search directories tend to provide the most consistent and well-clustered results. This advantage is generally limited solely to those classification areas already used in the taxonomy by that service. Yahoo, for example, has about 1,400 classifications (excluding what it calls 'Regional' ones, which are a duplication of the major classification areas by geographic region) in its current taxonomy. When a given classification level reaches 1,000 site listings or so, the Yahoo staff split the category into one or more subcategories. If a given topic area has not been specifically classified by the search directories, finding related information on that topic is made more difficult. Another disadvantage of directories is their lack of coverage because of the cost and time in individually assigning sites to categories.

Most searches of a research or cross-cutting nature tend to be better served by the search engines. That is because there is no classification structure behind the listings; only whether the keywords requested appear in that search engine's index database or not.

The flexibility of indexing every word to give users complete search control, such as provided by AltaVista or OpenText, is now creating a different kind of problem: too many results. In the worst cases, submitting broad query terms to such engines can result in literally millions of potential documents identified. Since the user is limited to viewing potential sites one-by-one, clearly too many results can be a greater problem than too few.

Increasingly, the growth of the Internet is causing the specialization or balkanization of search services. Lawyers, astronomers or investors, for examples, may want information specifically focused on their interest topics. By cataloging information in only those areas, users interested in those topics are better able to keep their search results bounded. Such specialization can also lead to more targeted advertising on those search service sites. Again, though, like the directories, such specialization can limit search results to the boundaries chosen by the service, which may or may not conform to the boundaries sought by the user.

The ultimate challenges to any of these centralized search services, therefore, are to: 1) keep pace with explosive document growth; 2) understand the "boundary" needs of their user communities; 3) provide sufficient "intelligence" to infer what users are really asking for even when their queries don't specify it; and 4) ensure sufficient coverage to provide one-stop searching. In the race for eyeballs, user retention and repeat visits are key.

Topic 3: How Search Services Rank Documents

A Web page, or document, can contain various kinds of content (as opposed to display or presentation options like sound, animation or frames), some of which is not shown when you view the document in your browser **[9]**:

- **Title** – an embedded description provided by the document designer; viewable in the titlebar (it is also used as the description of a newly created bookmark by most browsers)
- **Description** – a type of metatag which provides a short, summary description provided by the document designer; not viewable on the actual page; this is frequently the description of the document shown on the documents listings by the search engines that use metatags
- **Keywords** – another type of metatag consisting of a listing of keywords that the document designer wants search engines to use to identify the document. These too, are not viewable on the actual page
- **Body** – the actual, viewable content of the document.

Search engines may index all or some of these content fields when storing a document on their databases. (Over time, engines have tended to index fewer words and fields.) Then, using proprietary algorithms that differ substantially from engine to engine, when a search query is evaluated by that engine its listing of document results is presented in order of 'relevance.' Because of these differences in degree of indexing and algorithms used, the same document listed on different search engines can appear at a much higher or lower ranking (order of presentation) than on other engines.

Though not hard and fast, and highly variable from engine to engine, four factors tend to influence greatly the ranking of a document in a given query:

1. **Order a keyword term appears** – keyword terms that appear sooner in the document's listing or index tend to be ranked higher
2. **Frequency of keyword term** – keywords that appear multiple times in a document's index tend to be ranked higher
3. **Occurrence of keyword in the title** – keywords that appear in the document's title, or perhaps metatag description or keyword description fields, can be given higher weight than terms only in the document body
4. **Rare, or less frequent, keywords** – rare or unusual keywords that do not appear as frequently in the engine's index database are often ranked more highly than common terms or keywords.

Some engines, notably Excite, attempt to "infer" what you mean in a query based on its context. Thus, the meaning of **heart** can differ if the context of your search is cardiac disease as opposed to Valentine's Day. The methods by which these inferences are made are statistically based on the occurrence of some words in conjunction with others. Though useful for simpler queries, such inference techniques tend to break down when the subject of the query or its modifiers do not fit expected query relationships. For commonly-searched topics, this is generally not a problem; for difficult queries, it is a disadvantage to standard full-text indexing.

Cottage industries have emerged to help Web site developers place themselves higher in the search engines' listings (it is clearly more valuable to be within the first few listings sent to a user than be buried hundreds, or thousands, of documents lower). A constant battle is being waged between the engines and those desiring high listings from jimmying the system to "unfair" advantage.

Crude, early attempts to "spam" search engines to get higher listings included adding hidden terms like "sex" that were searched frequently but not the real subject of the document. Other techniques were to use certain keywords repeatedly, such as "cars cars cars cars cars" to get a higher frequency rating. Another was to cram the page with high-interest terms using the same color as the overall Web page, thus “hiding” the added keywords. The leading search engines have caught on to these and now have automated ways to prevent the worst of these spamming techniques.

More subtle techniques, however, are hard to prevent. For example, a listing for ski resorts in Utah could also add hidden tags for “Caribbean” or “beach resort” knowing that wealthy Caribbean travelers may also be looking to take ski vacations. If you as the searcher asked for Caribbean vacations you may logically wonder why you’ve gotten a listing for Utah ski resorts. It is because of such techniques (among others) that you can sometimes get document listings from a search that seemingly have nothing to do with your query.

So, differences in how search services rank documents, how developer’s themselves choose to characterize their Web documents, and just simple errors in how computers process and index these pages can all lead to highly variable ranking results from different search services.

Topic 4: Characteristics of Searchers and What Takes Search Time

Professional information searchers do not have a single style. There is no “correct” way to search on the Internet. Search styles have been described as ranging from ‘ants’ – the carefully planned, methodical search hoping to get exact results on the first try – to ‘grasshoppers’ – intuitively jumping from topic to topic, refining results as more is learned **[10]**. Only you can determine what your style is.

There is only one meaningful measure for a successful search: getting the results you desire. And within that context, there is only one meaningful basis for judging whether one search strategy or another is superior: whether those results are obtained faster.

Surfing and browsing on the Internet are seductive. One begins with an objective in mind, finds new tidbits of interest, and hours later can wonder where the time has gone. It is often difficult to apply metrics against whether the original search interest was obtained, or whether the whole process was productive or not. So, let’s look at some aspects of a typical search. The example assumes a 56.6 KB modem and a relative “fast” time for the Internet. This is perhaps an optimistic mid-range for current users of the Internet. The example is only meant to be illustrative:

Search Step	**Est. Process Time (sec.)**	**No. Repeats**	**Total Time (min.)**	**Cumulative Time (min.)**
Formulate Query	120	3	6.0	6.0
Issue Search	10	3	0.5	6.5
Get Search Listings from Service (30/query)	10	9	1.5	8.0
Review Documents; Select for Download	12	50	10.0	18.0
Download Document	15	50	12.5	30.5
Review Document	18	50	15.0	45.5
Average Time per Document (90 document example)				0.5

These estimates are likely an underestimate. Recently, information professionals using the Web to do searches in comparison with traditional online search services like Dialog found it took on average 2.4 minutes per document to get acceptable results **[11]**.

Whatever the actual “average” search time is, it will not apply to your circumstances in any case. However, what is the case is that certain aspects of searching can add delays to getting desired results and increase frustration:

- No matter how precise or accurate the query, a large percentage of results returned by search services will not be what you’re looking for
- Actual search time in getting candidate listings from services is relatively fast; the one-by-one document download and review is the most time consuming part of the process
- Larger listings of candidate documents from the services require more evaluation time
- Often too little time is spent on search and query formulation; any improvements you can make toward more precise and accurate queries will lead to fewer documents to review and faster overall times to the results you want.

The essential conclusion is that time is well-spent in understanding how to pose a proper query and how to take advantage of the way that search services work. These topics are the focus of the rest of this tutorial.

Part 3: Keywords – The Essence of the Search

Despite all the gobbledygook about things like 'Boolean' and query operators, the most difficult – and fundamental – aspect of a search are the keywords used in your query.

A search is inherently looking for information about a ***topic***. This part describes how you can proceed from search concepts to identifying the specific keywords – or terms – that will give you the results you're seeking. We begin by presenting an information problem which will be the basis for progressing through the tutorial's remaining topics.

Topic 5: Sample Information Problem for this Tutorial

Jan is an office worker in downtown Minneapolis. While on lunch break one fine Spring day, Jan's eye is caught by a flash in the sky above. Jan sees a bird about the size of a crow diving at high speed and catching in mid-air what appears to be a pigeon. The bird then swoops out of sight. Jan is captivated by the mostly gray and white bird, with the crooked black and yellow beak. Jan has never seen this bird before, and wonders what it is doing in the city. That night, Jan decides to find out more about this mystery bird on the Internet.

Where does Jan begin?

Topic 6: Query Concepts: What, Where, When, How, Why

Mastering the concepts behind a search is not as complicated as may seem at first. The first few searches are perhaps difficult, but, once done, the nuggets behind your information request start becoming clear. Like riding a bike for the first time, it does take some practice.

One of the bigger mistakes you can make in preparing a query is not providing enough keywords. On average, most users submit 1.5 keywords per query **[28]**. This number is insufficient to accurately find the information you are seeking. Thus, a central task in query formulation is for you to identify a sufficient number of appropriate keywords.

If you are new to searching, the first task we recommend when formulating a search is writing down what information you are seeking. This is best done – go ahead, use some paper and a pen – in the form of some questions. Before doing a search, it is important to bound your topic as completely yet succinctly as possible. After experience is gained, you can skip writing things down and plunge right into it.

Formulating a query is akin to solving a mystery. Some pieces of information are available, but if sufficient information were available the answer would be known and there would be no need to seek more. This is the essence of a query: missing information. It is up to you, the searcher, to define your snare – the query (quarry? pun intended) – sufficiently to trap that missing information and solve the mystery.

As any good detective would, it is useful to begin by listing what you do know according to these standard categories. Jan lists these for the mystery bird:

- **WHO / WHAT?** – gray and white bird, about the size of a crow; yellow and black beak
- **WHERE?** – downtown office buildings in the City of Minneapolis
- **WHEN?** – daylight in the Spring
- **HOW?** – fast flyer, hunting pigeons (?) as prey
- **WHY?** – hunting bird; why never seen before? blown off course? is it migrating?

TIP

Always keep in mind the **who**, **what**, **where**, **when**, **how** and **why** in formulating your query.

Of course, not all of these five categories will apply to a given query, and the specifics will obviously vary for your desired topic. But it is useful to keep these five categories in mind – the what, where, when, how and why – when analyzing the major components.

Topic 7: Breaking Down Your Query

Let's take the five responses to the query tests in **Topic 5** apart (yours will differ substantially, but the same ideas apply). First, there are many common words in these responses that are prepositions, conjunctions or common verbs. These include: **and, about, the, of, a, in, as, if, not, why, never, before, is** and **it**. These common words are referred to as "stoplist" words: they are essential to the connecting tissue in language, but they are filler in any search request. **All** search engines ignore them because they have minimal information value and are found commonly in all language. Search services include on the order of 600 of these common words in their "stoplists"; if you use them in a query they are ignored. Therefore, you should ignore them as well.

Okay, removing such words from our responses leaves these remaining words:

gray
white
bird
size
crow
yellow
black
beak

downtown
office
buildings
city
Minneapolis
daylight
Spring
fast

flyer
hunting
pigeons
blown
off
course
migrating

TIP

Never use articles, pronouns, conjunctions or prepositions – the connecting tissue in language – in your queries.

Now, let's further classify these terms into three categories, similar to diagramming a sentence (but made simpler for our purposes). Let's use the classifications of objects/nouns, actions/verbs and modifiers/qualifiers (adjectives, adverbs and predicate subjects). And, let's now re-list these words by these categories:

Objects	**Actions**	**Modifiers**
bird	blown	gray
buildings	migrating	white
city	not seen	size

Spring	crow
daylight	yellow
	black
	beak
	downtown
	office
	Minneapolis
	fast
	flyer
	hunting
	pigeons
	off
	course

Not all of these categories are equally useful in a query.

Topic 8: Focus on Nouns and Objects

Almost without exception, the central keywords in your queries will be nouns. Though sometimes adverbs and adjectives can help refine your search, the key pivot point is a noun, or series of nouns. Why is this?

The most precise terms we have in language are for tangible, concrete “things” or objects. Actions and modifiers are very diverse, easily substitutable, and generally not universally applied in any given description. For, example, take the concept of “fast”. A thesaurus will give 75 or more different words for fast. Here are some counts from AltaVista **[1]** for numbers of Web documents containing these terms:

fast	2,524,008
speed	2,210,325
quick	1,833,511
rapid	787,344
fleet	311,925
swift	180,903
breakneck	7,743

Or, alternatively, take a modifying concept like ‘color’. Again, here are the AltaVista document counts:

color	5,073,422
red	3,683,578
yellow	1,593,705
blue	2,946,413
gray	707,505
grey	469,630
slate	111,170
white	3,925,525

TIP

The keywords in your queries will most often be nouns – and then likely no more than 6 or 8 of them.

Note two aspects about these lists. First, a concept like speed or color can be described in lots of ways (most of which are not shown). Second, you generally don't know how others would describe the same thing. In our example of Jan's mystery hunting bird [**Topic 5**], would someone else describe it as "fast", "quick" or "like a bolt from the sky"? Would someone else describe the bird as "gray", "grey", "slate-gray" or "smoky"?

The same kind of ambiguity and substitutability applies to actions or verbs. Does the bird "fly", "soar", "swoop" or "glide", or any of the other dozens of ways the act of flying can be described?

As a general rule, try to avoid using action terms and mostly try to avoid using modifiers in your queries. Where exceptions to these guidelines may make sense is when a modifier helps to precisely define your object, such as in "Limburger cheese."

We've thus gone through a process that has led us to these possible objects as the focal points for constructing our query terms:

bird
buildings
city
Spring
daylight

The obvious main subject is **bird**. The next few topics will concentrate on it; we'll return to the other objects as we later refine our final query.

Topic 9: Word Stemming and Use of Wildcards

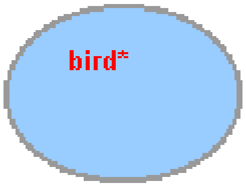
One of the first mistakes in query formulation is not using word stemming – or truncation – sufficiently. Let's look at this question in regards to our subject, **bird**. Accounting for singular and plural cases of an object is easy to overlook; but, if done, can act to unduly restrict the universe of documents in which you will be conducting your search. Using AltaVista again, here are the document counts for the single and plural versions of **bird**:

bird
birds
605,011
484,529

By using either only **bird** or **birds** as our subject, we would eliminate half or so of the potential documents that we'd like to use as our search basis. We could use both **bird** and **birds** as query terms, but that takes up valuable keyword slots. The better way to handle this problem is through truncation.

Truncation is applying a wildcard character after the first few letters in a term (the "stem"). The asterisk (*) is the almost universally accepted truncation wildcard. Generally, you must also have a minimum of three characters at the beginning of the word as your stem basis. Once marked for truncation, then any matching characters after that will be picked up in the search query. Some search engines do stemming and truncation for you if you pick the right option on the search form. Some engines don't support stemming or truncation at all. In any case, using the asterisk wildcard will generally be ignored or you'll get a query format error if the search engine doesn't support it.

Remember, ANY words with characters after the stem will be matched to your query term if the search engine supports truncation. Thus, if we stem **bird***, our search will match on the words **bird**, **birds**, **birding** and **birdbrain**. Posing **bird*** to AltaVista we now get these document counts:



1,076,900

Note the document count is a bit lower than the total for the individual words **bird**, **birds**, **birding** and **birdbrain**. There are minor errors in how search engines retrieve word stems. But they are of a smaller magnitude than ignoring singular and plural cases altogether in the query, and seem to be a minor price to pay for being able to eliminate another keyword (**birds**, in addition to **bird**) from the search.

As you first begin to use truncation you need to be aware of unintended consequences. In the case of the stem **bird*** there are relatively few unwanted words (**birdbrain**) picked up in the search. But let's look at another of the objects, **city**, in our mystery bird sample problem.

TIP

Truncation, or word stemming, keeps your keyword count down and makes for simpler queries.

To stem and pick up the plural form of **city**, **cities**, we would need to specify **cit***. But look at some of the words this stem specification would match:

citadel
citadels
citation
citations
cite
cites
cited

cities
citify
citizen
citizenry
citizens
citizenship
citrate

citric
citriculture
citrine
citrone
citronella
citrus
city

The **cit*** stem clearly picks up way too many unwanted words.

Stemming tends to work best when the actual stem is longer, when plurals are represented by an added '-s' (as opposed to '-ies' or other forms), and the stem itself is not a root to many other common words. With just a little thought, however, truncation is easy and can pay useful dividends in properly scoping your query with a minimum of keywords. We highly recommend its use.

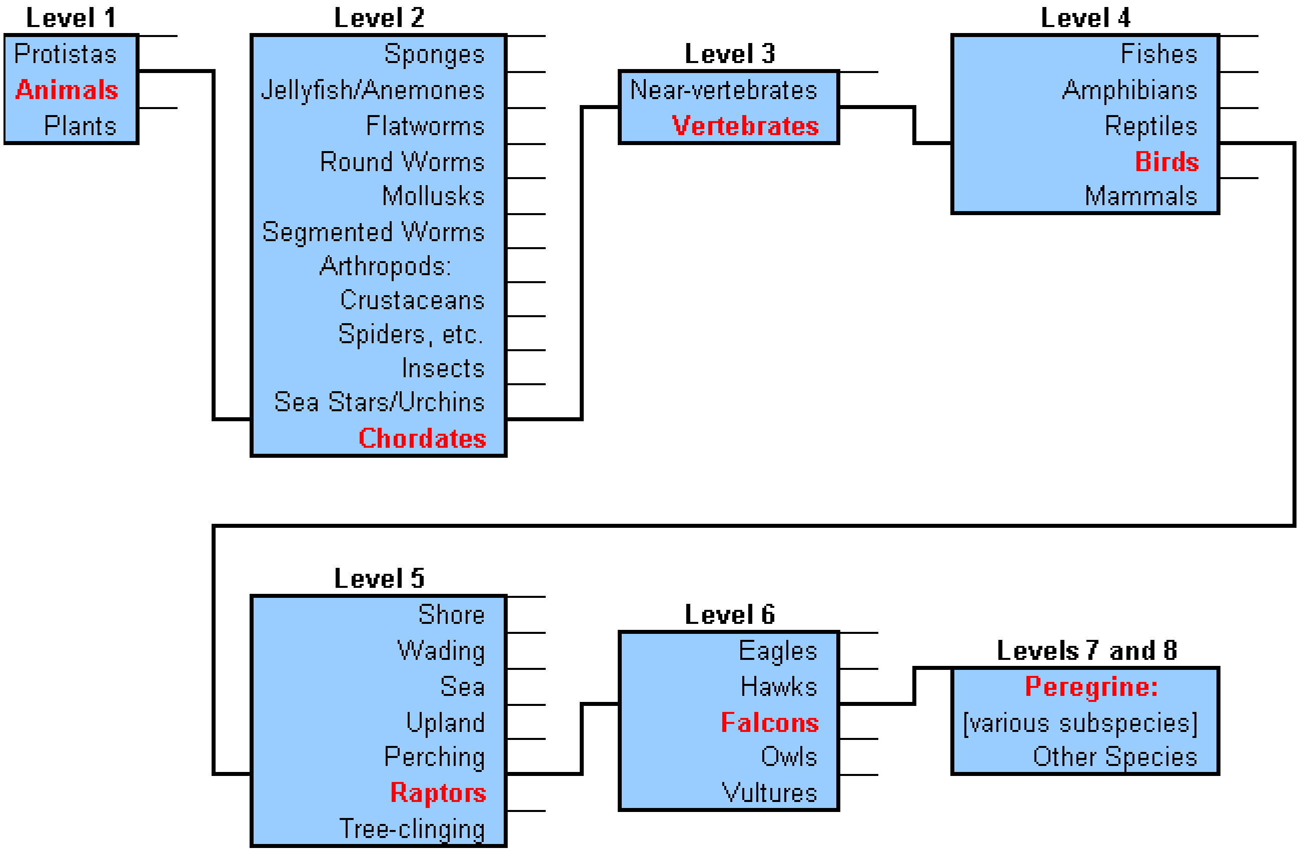
Topic 10: Finding the Right Level

Perhaps you've already noticed, but our query subject **bird*** is contained on more than 1 million documents (in AltaVista alone). It would be a little difficult to review all of those documents at one sitting.

THE MOST CRITICAL PROBLEM IN ALL QUERIES IS FINDING THE RIGHT LEVEL OF SPECIFICITY FOR THE SUBJECT QUERY TERM(S). Too broad a keyword specification, and too many results are returned; too narrow a specification, and too few are returned.

All information is classifiable and amenable to structure. We are all familiar with dictionaries, which classify words alphabetically. However, an alphabetical structure is not of much use to query formulation. But there are many other classification schemes used for information which CAN help find the right level, or specificity, for your keywords. A few examples appropriate to our mystery bird search are presented in this topic.

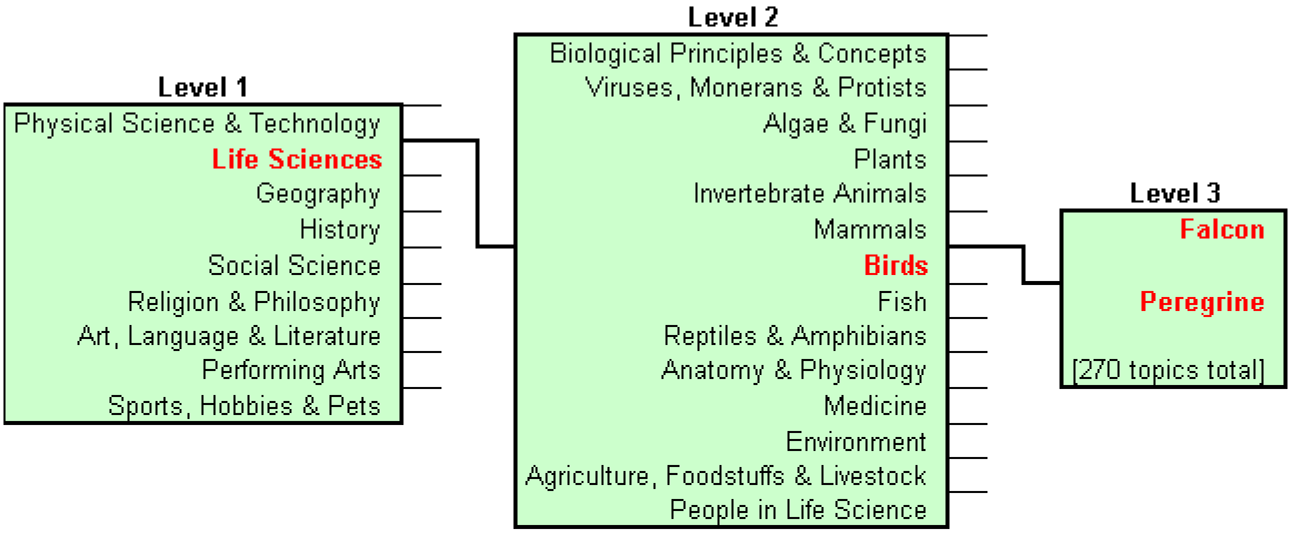
Our first example classification presents the structure of the animal kingdom **[12]**:



'Level' Example Using the Kingdom of Life

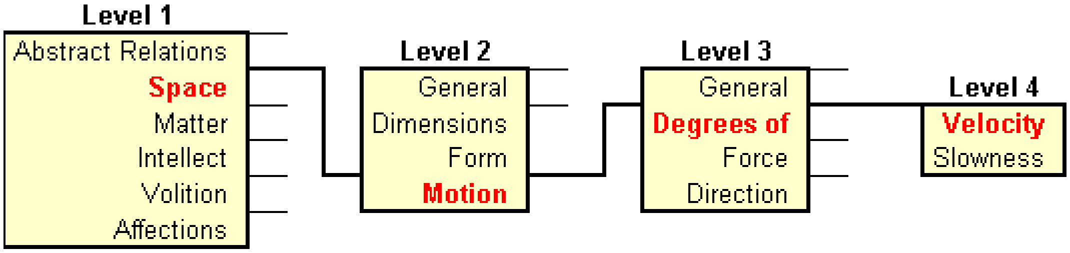
As we will see, our initial keyword term of **bird*** is at least three levels off of where it should be. Using **bird*** as is would lead to massive results sets from the search engines and virtually no likelihood that we will find the information we're looking for.

Another way to classify information is shown by the encyclopedia, with this example being drawn from Microsoft's Encarta 96 **[13]** (the actual encyclopedia doesn't matter; we're only illustrating a point).



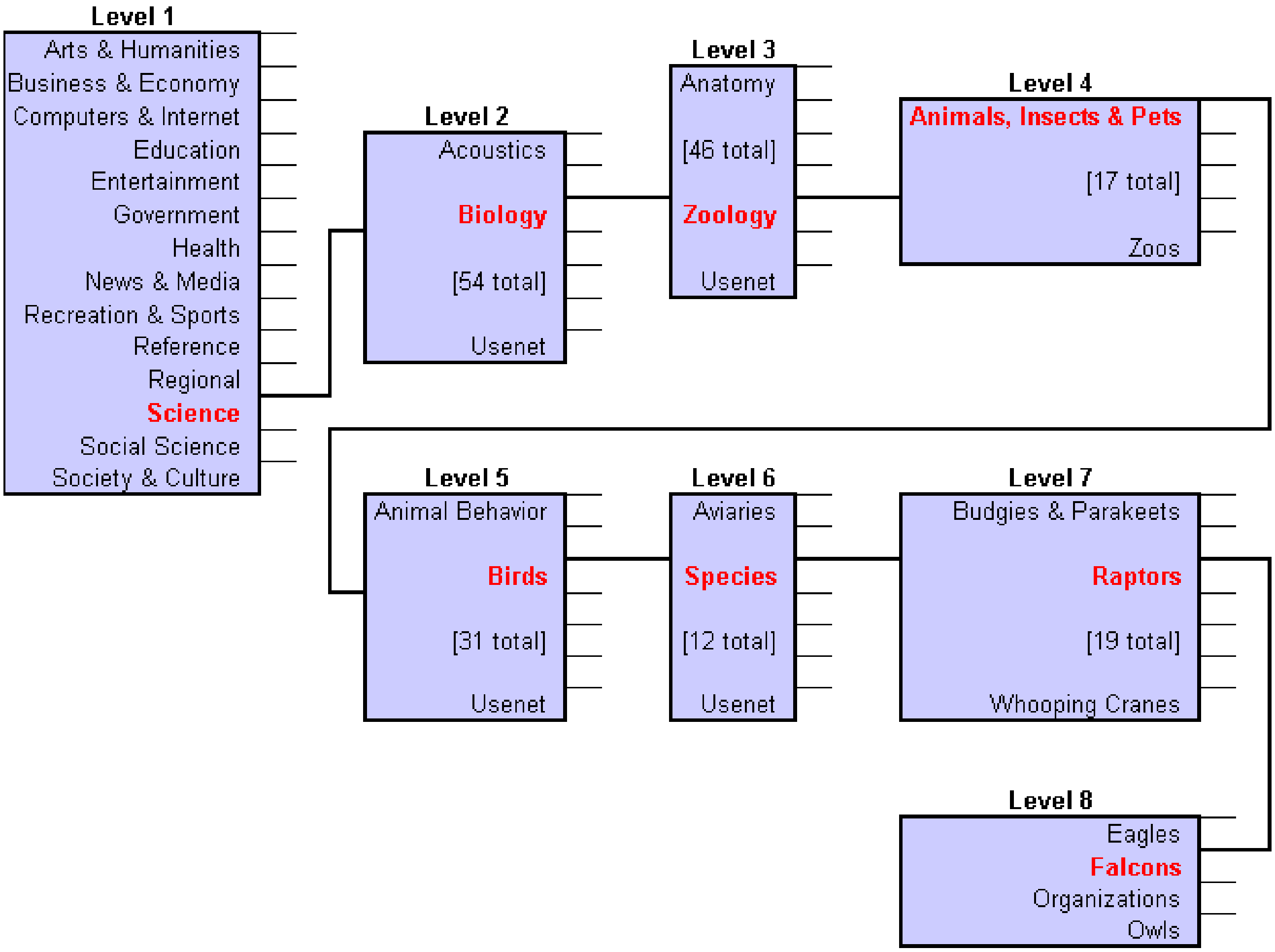
'Level' Example Using Encarta

As a very different example, the chart below shows how the word "fast" is placed within the structure of a thesaurus **[14]:**



'Level' Example Using Thesaurus

As noted, search 'directories' also apply a classification structure for how they organize and present Web sites. The structure for the largest and best known of these directories, Yahoo, with some 1400-odd individual categories, is shown below **[1]** :



'Level' Example Using Yahoo

Like the first animal phylum example above, **bird*** is about three or four levels off from where our subject keyword should be.

Finding the right level may involve your personal knowledge and experience, doing a preliminary search or consulting other references. In the case of Jan and the mystery bird, looking in a bird book was sufficient to match pictures with the bird seen as a **peregrine falcon**.

The time spent in finding how to characterize your subject at the proper level is definitely well spent, as these document counts from AltaVista illustrate:

bird*	1,076,900
falcon*	235,635
peregrine falcon*	9,157

By identifying our mystery bird as a **peregrine falcon**, we've narrowed the search by 99%! Remember, at 30 seconds to 2.5 minutes per document reviewed, the effort spent in zeroing in on the bird of interest has saved us tremendous overall search time.

The critical point about finding the right “level” in your keywords is that words at levels higher than where you should be return way too many results; those at levels lower than where you should be return too few or no results. This phenomenon is due to the fact that “things” at lower levels tend to “rollup” and sum into “things” at higher levels.

Philosophers, epistemologists, taxonomists, linguists and others can argue for centuries about “proper” ways to classify information. That is not our concern. Rather, the point is that keyword objects can be placed into a structure at various levels. Always keeping forefront whether your query subject is at the right level or not in those structures can bring big benefits in faster, and more accurate searches.

Topic 11: Synonyms

Let’s assume, however, that Jan was not able to match the bird book pictures with the mystery bird to identify it as a peregrine falcon. How can we use the query concepts identified in **Topic 6** to better hone in on what type of bird it is?

One useful place to begin is with synonyms. Jan knows the mystery bird is a hunting bird. Jan lists other synonyms that come to mind for **hunting bird**. We provide AltaVista document counts for these synonyms:

hunting bird*	1,448
bird* of prey	18,650

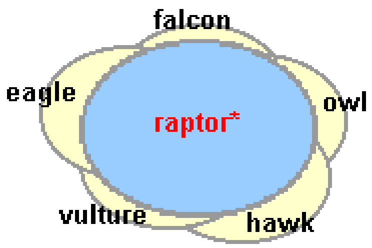
Jan, however, suspects neither of these terms is the “correct” synonym. Attacking this problem from another angle, Jan writes down specific kinds of birds of prey:

hawk
eagle
owl

Using these three keywords, Jan’s search immediately turns up a number of sites referring to raptors, the technical term for hunting birds. Jan finds a great site on raptors that also has pictures that positively identifies the mystery bird as a peregrine falcon **[14]**. Jan also learns that vultures are raptors, too.

The best synonyms provide relatively complete coverage for the subject at hand and are “pitched” for the right informational objective. In Jan’s case, it was needing to identify a specific bird, and a more technical term like “raptor” fit the bill. Were Jan’s interest more oriented to references in novels, perhaps “hunting bird” or “bird of prey” would have been more appropriate.

An illustration of a good synonym with proper coverage is:



Good Synonyms Provide Good Coverage

TIP

You can use synonyms both to find the right "level" for your query subject and to ensure proper coverage.

Good coverage is not always possible. Where not possible, provide a couple of alternate terms (that is, synonyms). But, remember, always play the numbers game. Your query terms are limited so choose them carefully.

Having determined the mystery bird to be a **peregrine falcon**, Jan considers whether synonyms for this term are also worthwhile. Based on what Jan has learned, these are the possible synonyms and document counts from AltaVista:

peregrine falcon*	9,157
Falco peregrinus	1,836
duck hawk*	111
all three combined	9,964

Again, note the three synonym counts do not exactly sum due to indexing gaps by the search engines. This example is a good instance where multiple synonyms do not buy enough increased coverage to be warranted. **peregrine falcon** is the most used description of this bird; adding the other terms increases coverage less than 10%.

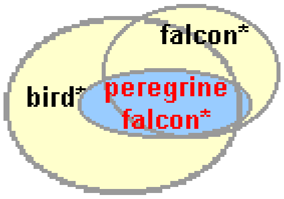
You need not get actual document counts from search engines in order to weigh such choices in your own queries. Simply use good judgment of what you're gaining – if anything – by adding more synonyms to your query subjects. Common sense should be a sufficient guide.

A thesaurus, a dictionary, personal knowledge or a preliminary Internet search can all be worthwhile places to find synonyms for the major subject(s) in your query. Generally, you should not waste the time thinking about synonyms for other terms in your queries, unless you know them to have very poor coverage.

Topic 12: Use of Phrases

Your most powerful keyword term is the phrase. Phrases are combinations of words that must be found in the search documents in the EXACT order as shown. You denote phrases within closed quotes (**"peregrine falcon*"**). Some search services provide specific options for phrases, some do not allow them at all, but almost all will allow you to enter a phrase in quotes, ignoring the quotations if not supported.

Why phrases are powerful is illustrated below:



Phrases Target Results

Again, using AltaVista document counts, the ability of phrases to zero in on desired results is clear:

bird*	1,076,900
falcon*	235,635
peregrine falcon*	9,157

Phrases should be used where the constituent terms are naturally married. Other examples would be "rain in Spain", "Gettysburg Address", "solar system" or "big bad wolf". Where two or more words are necessary to capture the subject, but may not always be next to one another in the same order, the **AND** or **NEAR** Boolean operators should be used [**Part 4**] .

TIP

Always look for natural phrases in your query concepts – they are one of the most powerful weapons available.

[When using phrases, it is important to consider nuances of the phrase that wouldn't normally be of concern. For example, the spaces between words are as important as any other character. If you include a double space between any two words in the query and the phrase typically has only one, the search will fail. Also, sometimes two dashes are used together on Web documents to approximate an en- or em- dash. If you include only one dash, the search engine may miss all those documents that use two. There is variability in the way certain search engines treat spaces, dashes, and the like. If you suspect there may a problem, consider submitting your phrases in different ways to capture these variations.]

In addition to **"peregrine falcon*"**, Jan also uses **"endangered species"** to help focus the search. Jan chose **"endangered species"** because information gained in identifying the mystery bird indicated that peregrine falcons were at risk of extinction in the 1970s due to DDT effects. Jan suspects that the answer to the **why** question of the search is the rarity of the bird and not migration or being blown off course. **"endangered species"** is a logical construct for a phrase because the terms are almost always used together to discuss organisms at risk of extinction.

We're now ready to begin discussing using structure in your query by using Boolean syntax.

Part 4: Boolean Basics

Despite its intimidating name, Boolean search techniques are really quite simple to learn and can add tremendous effectiveness to your searching. While working through this part, most of you will recognize constructs that were taught to you in high school math.

"Boolean" searching draws its name from George Boole, a mathematician and logician from the 19th century. He developed Boolean algebra, which is the basis for this form of structured search technique. Boolean algebra is also of prime importance to the design of modern computers.

Most information on the Web is highly unstructured. Boolean search techniques were first applied by information professionals to traditional search services like Dialog or Lexis-Nexis. Boolean techniques, while not supported by all Internet search services, provide a way for you to bring structure to this unstructured environment.

Without Boolean techniques, you are stuck with doing a lot of free-text searching, meaning, looking for documents that contain words you think will be in the document you are seeking. Sheer document volume makes free-text searching difficult and prone to failure. Boolean techniques give you the power to narrow your search to a reasonable number of potentially useful documents thereby increasing your likelihood of success.

Topic 13: Boolean Overview

Boolean logic is used to construct search statements using logical **operators** and specified **syntax**. These are combined into **Boolean expressions**, which always are either true or false when evaluated.

The shopping list of operators and syntax available to Boolean searching (though not supported by all Boolean search services) is:

- **AND** – terms on both sides of this operator must be present somewhere in the document in order to be scored as a result
- **OR** – terms on EITHER side of this operator are sufficient to be scored as a result
- **AND NOT** – documents containing the term AFTER this operator are rejected from the results set
- **NEAR** – similar to **AND**, only both terms have to be within a specified word distance from one another in order to be scored as a result
- **BEFORE** – similar to **NEAR**, only the first (left-hand) term before this operator has to occur within a specified word distance **before** the term on the right side of this operator in order for the source document to be scored as a result
- **AFTER** – similar to **NEAR**, only the first (left-hand) term before this operator has to occur within a specified word distance **after** the term on the right side of this operator in order for the source document to be scored as a result
- **Phrases** – combined words or terms that must appear directly **adjacent** to one another and in the phrase order for the source document to be scored as a result
- **Wildcards** (stemming) – beginning characters that must match the same beginning characters in a document's words in order for it to be scored
- **Parentheses** – nested operators that are evaluated in an inside-out, then left-to-right order of precedence.

Examples uses of these operators are based on the sample tutorial problem of finding information on the peregrine falcon discussed in **Topics 5 - 12**.

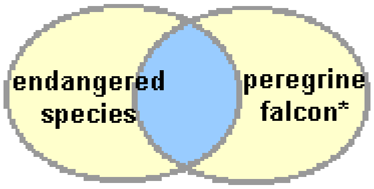
The underlying premise of Boolean logic is set theory. The **AND** operator is equivalent to the set **intersection** operation; the **OR** operator is equivalent to the **union** set operation. To help explain these concepts, specific topics below use so-called Venn diagrams. Don't worry about the fancy name. The diagrams are color-coded to indicate the result of an operation. The universe of possible results is shown in yellow on these diagrams; the accepted results in blue.

One way to decide when to use the **AND** or **OR** operators is to test whether your keywords are different concepts, or a just different ways (synonyms) to say the same thing. For different concepts, use **AND**; for synonyms, use **OR**.

Boolean search syntax needs to follow a precise structure. Queries constructed using Boolean syntax do not look like real sentences. The **AND** and **OR** Boolean operators, in particular, sometimes seem to mean the opposite of what they do in natural language. Searching based on simple sentences and phrases is a different construct known as **natural text searching**.

Topic 14: AND Operator

AND means "I want *only* documents that contain ***both*** words." **AND** logic focuses, coordinates and narrows a search. The connector **AND** narrows a search, retrieving only those records containing at least one term or phrase from each concept. The **AND** operator is a binary one; that is, it operates on the terms or phrases on both sides of it. It is the same concept as **intersection** in set theory.



Example of AND Operator

Using AltaVista document counts, the results of the query **"endangered species" AND "peregrine falcon*"** is:

endangered species	110,626
peregrine falcon*	9,127
endangered species AND peregrine falcon*	2,166

Note the **AND** operator says nothing about where the terms or phrases are located in the document with respect to one another, nor whether their linkage makes sense or not. This operator only requires that the terms or phrases immediately on both sides of the **AND** must both appear in the document.

The **AND** operator can be used to chain a number of required terms or phrases together, all of which must be present in order for the outcome to be a successful result. For example, the query

London AND “Big Ben” AND “Buckingham Palace” AND Trafalgar would only return documents that contained all four terms or phrases.

TIP

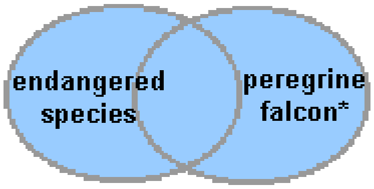
AND should be your most frequently used Boolean operator.

The **AND** operator is also a very useful qualifier. For example, AltaVista counts for **falcon*** total 235,635. Some of these references are to cars, others to various companies, falconry or a sundry of products using the name falcon. To zero in on the falcon bird, a search phrase of **bird* AND falcon** removes these extraneous references. The AltaVista document count now becomes 31,615.

False “results” can be common using the **AND** operator. For example, let’s apply Jan’s query of **endangered species AND peregrine falcon*** to a large document discussing unusual birds. In one section it could discuss the 200 mph diving speed of peregrine falcons; in another the extinction of the dodo bird. A positive result would be scored for this document, even though there is no discussion about the endangered status of peregrine falcons. One of the reasons these false positives occur on the Internet is the occurrence of large Web documents that simply list links or references to other documents and contain HUGE numbers of terms. They often produce false results.

Topic 15: OR Operator

OR means “I want documents that contain ***either*** word; I don't care which word.” **OR** broadens a search and makes it less focused. It is equivalent to the **union** operator in set theory. Again, using our peregrine falcon example, the results set for this operator looks like:



Example of OR Operator

The document counts from AltaVista using this **OR** operator are:

endangered species	110,626
peregrine falcon*	9,127
endangered species OR peregrine falcon*	107,745

These results illustrate some interesting facts. First, the **OR** operator is NOT equivalent to a sum. Documents which contain both phrases still get counted as a single document. Second, we would expect at minimum the **OR** operator to result in a total number of documents no smaller than the count of documents for the largest term or phrase in the operation (*i.e*,. **“endangered species”** with 110,626 counts). Yet our result set is smaller than this. Why?

Strictly speaking the results shown should not happen. The reason they do is based on the lack of 100% indexing of documents by full-text indexing search engines. This is not meant to be a criticism of the search engines. Probably most errors occur because of improperly formatted Web pages. And, after all, engines are indexing millions of pages in very short periods of time. The fact they do accurately index very high percentages is remarkable. But, you, as a searcher, should be aware results are not foolproof.

TIP

Use **OR** to string together synonyms; be careful about mixing it in with **AND** !.

The **OR** operator can be used to chain a number of terms or phrases together, any one of which must be present in order for the outcome to be a successful result. For example, the query **London OR “Big Ben” OR “Buckingham Palace” OR Trafalgar** would return all documents that contained one or more of these four terms or phrases. As with the **AND** operator, there is no assurance that any of these terms or phrases are logically or conceptually linked in any of the results documents.

Unless used in parenthetical clauses (most useful for synonyms) or as a fishing expedition as part of preliminaries to a search, we do not recommend the use of the **OR** operator. Overuse of the **OR** operator can cause results sets to grow too large to be useful.

Nonetheless, the **OR** operator is one of the two main operators within Boolean syntax. It should be used in a controlled way to expand your results set, most often as part of a parenthetical argument.

Part 5: Advanced Operators

There are four additional Boolean operators that provide more fine-grained control than the basic **AND** and **OR**. These operators are less frequently used and are not all supported by search services with basic Boolean capabilities.

Topic 16: NEAR Operator

Remember for the **AND** operator that the terms or phrases on both sides of the operator can appear *anywhere* in the document in order to get a successful result. One example above described how a successful result for **"peregrine falcon*" AND "endangered species"** could be obtained, even though the falcon reference was to 200 mph diving speeds and the endangered species discussion was many pages later dealing with the dodo bird. The **NEAR** operator is designed specifically to avoid such false results.

The **NEAR** operator requires the two phrases or terms to be within a specified word count of one another to be counted as a successful result. Generally, most search engines that support the **NEAR** operator have a set value of a ten word maximum distance. A few [see **Topic 38**] allow you to specify a word distance of your choice if you supply an additional argument. Some engines also use **ADJ** (for adjacent) as the equivalent operator to **NEAR**.

The **NEAR** operator does not care which of the phrases or terms on either side of the argument comes first or not, just that the two phrases or terms are within the specified distance.

The **NEAR** operator is a great way to ensure that your search terms occur within the same sentence or same paragraph. It is a very useful way to remove large, comprehensive Web sites that have a reference to everything under the sun, but not specific information of use to your search.

TIP

Use **NEAR** as an alternative to phrases and an improvement to **AND**, ***but only*** when you know the concepts are closely linked.

The **NEAR** operator can have drawbacks, however. It is possible to overlook the definitive document on endangered peregrine falcons, for example, if in one section of the document it uses peregrine falcon but elsewhere when its endangered status is discussed it only uses the word peregrine. It is very difficult in all cases to foretell how document authors will use, repeat or link such terms.

Another drawback is the relatively few search services that support this operator. This problem can be overcome when using third-party search tools that work on the results of search engines but support this operator themselves.

But, if your terms can pass the test of confidently appearing within a sentence or so of one another, we recommend you consider the use of the **NEAR** operator.

Topic 17: BEFORE and AFTER Operators

The **BEFORE** and **AFTER** operators work in the exact same manner as the **NEAR** operator, only you can now specify which terms or phrases need to come first or second. In the case of the **BEFORE** operator, the first term or phrase MUST occur before the second term or phrase within the specified word distance. In the case of the **AFTER** operator, the first term or phrase MUST occur after the second term or phrase within the specified word distance.

These operators do provide even greater control to your searches. But their drawbacks are even more severe than the **NEAR** operator. First, not only must your terms appear within the word distance, but you also must get the order right. Second, to our knowledge, only two major search engines support these operators [see **Topic 38**].

For these reasons we've included these operators here for the sake of completeness, but we do not recommend that you seriously consider using them . If you become an Internet 'power searcher' and you decide you disagree with this recommendation, then your skills have surpassed the purpose of this tutorial anyway.

Topic 18: AND NOT Operator

AND NOT removes any documents that contain that term or phrase. **AND NOT** is a unary operator; that is, it only works on the term or phrase that immediately follows the operator. It does not evaluate terms or phrases on both sides of the operator.

Most of the major search services support the **AND NOT** operator. It is sometimes called **BUT NOT** or **NOT** and sometimes denoted by placing a minus sign (-) before the term or phrase to be removed.

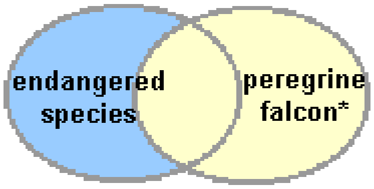
[**NOTE:** Technically **NOT** is the unary operator. For example,

NOT falcon

would exclude all documents that use the word **falcon**. The problem arises in the middle of a query. While some search engines allow **NOT** by itself, such as:

falcon NOT car

which would return documents using the word **falcon** but not **car**, the statement is technically ambiguous as to how to treat **falcon**. As a result, most engines require matching **NOT** in the middle of a query with **AND** or **OR** (**OR NOT** is rarely used). This removes the ambiguity and is the form we've adopted herein for use within the middle of a query.]



Example of AND NOT Operator

Again using AltaVista document counts, here are the results for this operator:

endangered species	110,626
peregrine falcon*	9,127
endangered species AND NOT peregrine falcon*	98,307

As discussed for other operators, search services indexing accuracy is not 100%.

AND NOT is a very powerful command that should be used with care. **AND NOT** works to narrow a search, subtracting all citations that contain the specified term or phrase.

AND NOT is completely non-discriminatory; it only takes one instance of a word to eliminate a document from your results set. As one source describes it, think of **AND NOT** logic sort of like peeling a potato **[16]**. A peeled potato is **potato AND NOT peel**. There's only one trouble: some of the good part of the potato goes with the peel. So, use the **AND NOT** operator with as much care as you would a paring knife, and only when you’re absolutely sure you want to exclude a term or phrase from your results.

TIP

AND NOT is a powerful operator, use with care! A single instance will cause a document to be excluded.

Generally, we do not recommend using **AND NOT** in the beginning iterations of a search. See what results are obtained in the early steps before applying this operator, if at all. Then, apply it incrementally to make sure you’re not stripping away too much of the fruit.

A good example of where this might apply is with the **falcon*** search noted for the **AND** operator. The term **falcon*** returns references to cars, products, companies and place names, in addition to birds. Successively applying **AND NOT** to **car***, **product*** and **compan*** is another approximation to the search **bird* AND falcon***. On the other hand, using **AND NOT** with **place*** could be going too far by eliminating references to falcon bird sightings that occur in various places.

Though in this example we have a good **AND** qualifier in **bird*** for our interest in peregrine falcons, a suitably encompassing word such as **bird*** may not apply to other search topics. In these cases, **AND NOT**, judiciously applied, can be an alternate way of getting to the same end.

Part 6: Advanced Construction

This part builds on the Boolean operators and basic search concepts previously discussed to show how they can be combined into effective, complete queries. Much of the discussion concerns how to construct proper syntax. This part ends with a reprise of our sample search problem for Jan's mystery bird [see **Topic 5**].

Topic 19: Use of Parentheses

Search services that support structured (Boolean) syntax do not always read from left to right like we do. Instead, they read "inside-out", in order of the nested levels of arguments set off by parentheses. Each bounded argument set off by parentheses is called a **Boolean expression**. (The entire query is also assumed to have parentheses around it, whether you put them in or not.) This is the same concept drummed home in high school math in how to evaluate an algebraic expression.

Learning how to construct this Boolean syntax structure is easy. You only need to remember four things:

1. You define a Boolean expression through use of an open parenthesis ['('] to begin it, and a closed parenthesis [')'] to end it
2. Make sure the first search concept you want evaluated is at the inner-most level of your Boolean expressions; followed by subsequent expressions in your desired order
3. Make sure you have a balanced (equal) number of open and close parentheses in your entire query
4. Expressions at the same "level" are read in order, from left to right.

It is really worth your time to master these simple rules. It adds immensely to your control over your queries and their ability to return the results you desire.

Though some search services support quite a few layers of nested Boolean expressions, in practice the amount of nesting you need or is even desirable is quite low, likely no more than three at most. To show a three-level example, consider the following dummy query:

THIRD expression (SECOND expression (FIRST expression evaluated) evaluated) evaluated

Note, you do not need to put parentheses around the entire query; the outermost layer is evaluated last in any case. But, even when you think the computer is going to do what you want, it is always safer to use parentheses if there is even a chance of confusion. Parentheses will also help you read your own searches.

TIP

Don't heavily "nest" your parentheses. Remember, ***keep it simple***!

In the absence of any nesting, or with expressions at equivalent levels, the order of query interpretation is from left to right. For example:

FIRST expression AND SECOND AND THIRD AND FOURTH

or,

(FIRST main subject) AND THIRD expression AND (SECOND

expression)

AS A GENERAL RULE, YOU SHOULD ALWAYS PLACE YOUR MAIN SUBJECT TO BE EVALUATED FIRST. This is because many search engines determine the rank order of document results by relevance, with first query terms to be evaluated ranked higher. This rule can be a bit tricky until you get used to it. For example, taking the last query example above, but forgetting the initial set of parentheses shown, produces the following:

SECOND main subject AND THIRD expression AND (FIRST expression)

Using the form above, if you placed your main query subject first in your query expecting it to be evaluated first, you would get the unintended consequence of having it evaluated second.

TIP

Don't assume an evaluation order. Specify the order you want by using parentheses.

Finally, Boolean operator precedence is enforced by most search engines with **AND** and **AND NOT** being evaluated before **OR**. If you have doubts of operator precedence, consult the help system for the search engine being used. Our recommendation: eliminate ambiguity as to how a given engine treats operator precedence by explicity putting your expressions into parentheses in the evaluation order you desire.

The **OR** operator should generally be used solely within nested expressions, and then mostly to capture synonyms.

For example, you may recall from our sample problem of Jan's mystery bird [**Topic 5**] that Jan wanted the concept of having seen the bird in the city as part of the query. Also recall there is a problem with picking up too many unwanted words when city is truncated as **cit***. A good way to handle this problem is with a nested Boolean expression using **OR**. Thus, to capture both the singular and plural forms of city, Jan would write:

(city OR cities)

This expression now covers the singular and plural without inadvertently adding undesired words (such as 'citizen' or 'citrus') to the query term list.

Whenever you mix Boolean operators in a query you should always use parentheses to force the evaluation order you want. This helps avoid unintended consequences. For example, the following query without parentheses.

hawks AND eagles OR falcons AND owls OR vultures

Is actually evaluated as:

(hawks AND eagles) OR (falcons AND owls) OR vultures

The result of this expression is not very useful. The expression does not require any one term. You could end up with pages containing only vultures or only owls and falcons or only hawks and eagles. This is most likely not the way you intended it.

Lastly, there are times when parentheses are not needed. This is when all operators are either **AND** or **OR** in the query. For example,

hawks AND eagles AND falcons AND owls AND vultures

or,

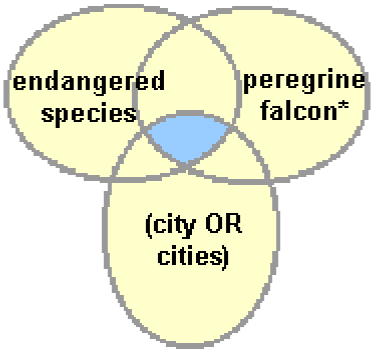
hawks OR eagles OR falcons OR owls OR vultures

The former requires all five types of bird to be included in a successful document; the latter only one. Additional examples of possible pitfall query syntax is shown in **Topic 29**.

Topic 20: Combining Concepts for Power Searching

A good rule of thumb when searching for relatively hard-to-find information on the Internet is to juxtapose three "concepts" in your query (we've also used the term **Boolean expression** to represent a "concept"). The first concept should be your subject, defined at the proper level [**Topic 10**], with synonyms or phrases as appropriate to provide adequate yet accurate subject coverage. The other two concepts should correspond to two of the when, where, how and why concepts discussed in **Topic 6**.

Each of these concepts should be provided as a Boolean expression with the **AND** operator connecting all three. In the case of Jan's mystery bird example, the resulting query can be represented as:



Combine Concepts in Query

Note how this acts to restrict your final results space. Posing this query to AltaVista in the form:

("peregrine falcon*") AND ("endangered species") AND (city or cities)

produces a results set of 810 documents. This number may sound like a lot, but remember we began with millions, and as Jan discovers, the first twenty of which (at least) directly respond to the desired results **[17].** The actual results from this search are discussed in **Topic 23**.

You should generally not need to exceed three concepts in a successfully constructed query; four is unusual. If you find you can't narrow them to two or three, double check to be sure all the concepts are necessary and all are at the right level.

TIP

Try to link three concepts together in your queries, joining with the **AND** operator.

Topic 21: Punctuation and Capitalization

Not all search engines handle punctuation equivalently. When in doubt, you should consult the help file of the search engine you are using. The guidance below, however, should be generally applicable to most engines that support structured, Boolean syntax:

Standard Syntax	Meaning	Alternative Syntax	If Not Supported
AND	both required	+	ignored
OR	either required	blank	all support
AND NOT	exclude following	-, BUT NOT, NOT	ignored
NEAR	required within set word distance	ADJ	ignored
BEFORE	first required before within distance		ignored
AFTER	first required after within distance		ignored
( )			ignored
“ “	treat as phrase	checkbox option	
*	stem word	checkbox option	ignored

Also, most search engines are insensitive to whether you use upper, lower or mixed case in your queries. If you use lower case, most engines will match on both upper and lower case. For general searches, it is the safest form to use. Where the engine does support upper or mixed case, if you use upper case characters the engine assumes you want an exact match. Most engines also do not care if you use upper or lower case for Boolean operators.

For the few engines that do support capitalization, you can use this fact to advantage in finding proper names or place names. See **Topic 38** for the capitalization features of major services.

Topic 22: Multiple Queries and Query Refinements

Strictly speaking, only one current Internet search tool supports multiple, simultaneous queries [see **Our Solution**]. However, a number of the search services support being able to pose additional queries to a previous results set [see **Topic 38**].

These can be very valuable techniques to you as a searcher. It enables you first to cast a fairly broad query, and then successively hone in on desired results. With the search services, you can also use your browser’s back arrow to try a search, evaluate, and, if you don’t like, to back up and start over again.

As you first begin trying more advanced query techniques, we highly recommend that you start with those services that support query refinement. It gives you a way to test out ideas and put into action some of the concepts discussed here.

Topic 23: Sample Information Problem Revisited

In **Topic 5**, we met Jan, who encountered a mystery hunting bird. Through successive refinement of the subject, Boolean expressions and query syntax, Jan found a listing of 810 Web documents, the most highly ranked of which met the desired results [**Topic 20**].

Here's what Jan discovered:

- The mystery bird was a male, peregrine falcon. Nearly lost to extinction, in at least the Eastern U.S., the bird was making a stunning comeback through a combination of breeding-and-release programs and a cleaner environment free of DDT
- Peregrine falcons had found a natural home in downtown cities, where the building ledges gave them protection as their natural cliff habitats had, and where there were plenty of delectable pigeons to feed on
- Breeding pairs of peregrine falcons were now found in such urban areas as Cincinnati, Dayton, Columbus, New York City, Cleveland, Toledo, Chicago, Milwaukee, Toronto, Montreal, Philadelphia, Wilmington, Baltimore, Washington, DC, Salt Lake City and Pittsburgh
- From a base of zero in the 1970s, there are more than 1,000 breeding pairs now known East of the Rocky Mountains
- Live-cams showing peregrine falcon nests on building ledges are now being beamed 24 hrs per day over the Internet from Toronto, Montreal, Columbus and Pittsburgh
- Jan's sighting in Minneapolis was the first recorded in that city
- Tremendous additional information was gained about great viewing sites for peregrine falcons at nature preserves and general information about the species **[18, 19, 20, 21]**.

Jan came to understand that the recovery of peregrine falcons was one of the great environmental success stories of the past two decades. Jan is presently setting up Minneapolis' own live-cam to monitor the new breeding pair in that city. Jan is also a local celebrity and resident authority on peregrine falcons.

Part 7: Pitfalls to Avoid

This part describes many of the common errors made by Internet searchers. Some are within the control of you, the searcher. Others are due to the rapid growth of the Internet and the inherent limitations to search services on the Internet.

Topic 24: Avoid Misspellings

You know, it's so obvious that it is most often not mentioned: Searchers on the Internet are atrocious spellers. See for yourself. The two links below enable you to monitor in real time the queries being issued on the Internet. Observe for yourself bad spelling, not to mention bad query construction. (WARNING: the links you are about to see may contain graphical sexual content; another common feature of searching on the Internet.):

http://WebCrawler.com/WebCrawler/Fun/SearchTicker.html
http://search1.metacrawler.com/perl/metaspy

It is not the purpose of this tutorial to rap people on the knuckles if they misspell words. But, in your query and searching, if you misspell your keywords, you are immediately penalized. Let's do a little exercise to test this with the terms **query** and **searching** used in the previous sentence. Again, our document counts are based on AltaVista:

query	1,198,738
querry	2,049
qerry	1
kwerrie	1
searching	968,831
serching	795
searchng	187
seerching	8
sherching	3

Clearly, Web developers also misspell words on their own documents (don't we all!).

Computers and indexing algorithms are inherently stupid. If the Web developer misspells a word, it is entered as such on the database. If the searcher issues a misspelled query term, that is what is searched for. So, recognize that computers are stupid and guard against these mistakes yourself. Sloppy entry of query terms will cost you time and cause you frustration.

Topic 25: Redundant Terms

Think of constructing a query as being in a card game. You have only so many cards (terms) to play to get a winning hand, or successful results from your query. Using redundant terms "burns" one of your cards, and diminishes your prospects for success.

TIP

Limit your keywords to six to eight. Check to make sure you're not duplicating "levels" in your terms.

Redundant terms mostly arise from combining terms from multiple "levels" dealing with the same concept [see **Topic 10**]. For example, in Jan's search case, the subject of the query became **peregrine falcon***. Were Jan to also add **bird*** to the query it would repeat information – at the wrong level to boot.

You can generally spot redundant terms by asking the question, "Is this term already covered by another term?" If the answer is yes, pick the term at the appropriate level and discard the other one.

Topic 26: Ignored Terms

There is an emerging class of words that are becoming like stoplist terms – often ignored by the search engines because of their ubiquity on the Internet. Examples include: computer, Internet, Web, sex and software. These words, and others like them, are not always ignored. It appears that at high-demand search times that some of the engines choose to ignore processing them.

Should you experience such behavior, one solution, if you indeed need to use such ignored terms in your query, is to make sure that you place these words in quotes or make them part of a phrase. The ignored behavior appears to be limited to use of such terms as individual words in queries, and then only at some times of the day.

Topic 27: Alternate Spellings

English has become the standard language for Internet communications. However, some of the largest user domains on the Internet come from a background of traditional public school (U.K.) English. There are perhaps 50 countries around the world whose English is traditional, and not based on usage and spelling in the United States.

As a searcher, you should be aware that many common terms – colour/color, organise/organize, behaviour/behavior – may differ in spelling between these two forms. If you suspect that a keyword in your queries may have alternate spellings, we advise you to treat these alternates in the same way you handle synonyms: list both forms in an **OR** Boolean expression.

Topic 28: Too Many Terms, Synonyms

We have recommended throughout this tutorial two overall guidelines for the size of your queries:

- Limit the key concepts (*e.g.*, Boolean expressions) to three or fewer; under rare occasions this guideline can increase to four
- Keep the actual terms in your queries to no more than six to eight.

These guidelines are not just a goad to refine query construction, content and syntax. They are also driven by experience that indicates that at high numbers of term counts search engine behavior can become erratic and unpredictable.

It is difficult to judge the latter point, since each search service closely guards how it indexes, retrieves and scores queries. Attraction of eyeballs has become a highly-competitive factor of the Internet; many are vying to gain advantage in where they are listed on search engine results; and there are real technical demands to serve all search requesters in real time at peak demand periods.

The fact that search service rules are today opaque is unlikely to change any time soon. As users, we are left with observing engine behavior, reading the public help documents, and gleaning insights from others on the Web who have been focused on similar questions. This is not really an attractive state of affairs. Absent definitive and public disclosure by the search services of how they handle these matters, room for misinterpretation and misunderstanding looms large.

Such disclosure is unlikely to happen in the foreseeable future. Searching has become big business on the Web, and as the starting point for most users and most searches, will likely remain so. In this competitive, market share-and revenue-driven environment, the incentives for major search services to disclose more than they already are doing is minimal, and will possibly even diminish.

Topic 29: Improper Boolean or Complicated Construction

Part 6 describes advanced construction of Boolean queries. This topic elaborates on four pitfalls that you may encounter:

- Excessive nesting or terms, which search services may not process in all instances and which may not achieve what you want the query to do
- Unintended results from combining the **AND** and **OR** operators
- Improper (and unintended) use of the **AND NOT** operator
- Unbalanced parentheses.

Let's reprise a complicated form of our standard mystery bird query, only this time focusing on citations in those cities which are known to have Internet live camera shots of falcon breeding pairs. The number shown after the query is the number of documents identified by AltaVista. Let's say our first query is as follows:

("peregrine falcon*") AND ("endangered species" OR extinct*) AND ((Montreal OR Toronto OR "New York" OR Columbus OR Pittsburgh) AND breeding) [294 counts]

Whew! That's a complicated query. Let's also say that we are ambivalent about whether the endangered species status or the listing of cities both need to be in our results set. We could thus change the query as follows:

("peregrine falcon*") AND ("endangered species" OR extinct*) OR ((Montreal OR Toronto OR "New York" OR Columbus OR Pittsburgh) AND breeding) [35,116 counts]

Whoa! Why did the results set zoom to more than 35,000? First, because of the precedence order of evaluating nesting, the query above is really being evaluated as follows:

(("peregrine falcon*") AND ("endangered species" OR extinct*)) OR ((Montreal OR Toronto OR "New York" OR Columbus OR Pittsburgh) AND breeding) [35,116 counts]

This really amounts to both sides of our query being evaluated independently, and then combined:

("peregrine falcon*") AND ("endangered species" OR extinct*) [2,607 counts]

((Montreal OR Toronto OR "New York" OR Columbus OR Pittsburgh) AND breeding) [30,007 counts]

Clearly, this is not what we intended. We can try to fix the evaluation order by changing the nesting order by now bracketing around the two concepts for which we didn't have a preference, endangered species status or presence in one of the named cities:

("peregrine falcon*") AND (("endangered species" OR extinct*) OR ((Montreal OR Toronto OR "New York" OR Columbus OR Pittsburgh) AND breeding)) [2,972 counts]

The main point of these examples is that combining **AND** and **OR** operators in long, complicated queries can lead to undesirable results and some difficulty in figuring out what is being evaluated first.

A more important point is to slim down your query terms and make your construction simpler. Taking the first query above, let's do that. We first get rid of **extinct***; we think it is covered pretty well by **"endangered species"**. We then decide to eliminate the **breeding** term because we deem it to have much lower informational value than the other query concepts. Finally, we will put all of the concepts at the same evaluation level by linking them with **AND** operators and putting each within its own parenthetical listing. Our streamlined query now becomes:

("peregrine falcon*") AND ("endangered species") AND (Montreal OR Toronto OR "New York" OR Columbus OR Pittsburgh) [487 counts]

Now, our results set has become acceptably low, and the query is easier to read and understand.

As one final refinement, we could choose to use the **NEAR** operator to make sure these key query concepts are indeed related in our source documents. Here are the results of trying that:

("peregrine falcon*") NEAR ("endangered species") AND (Montreal OR Toronto OR "New York" OR Columbus OR Pittsburgh) [109 counts]

("peregrine falcon*") AND ("endangered species") NEAR (Montreal OR Toronto OR "New York" OR Columbus OR Pittsburgh) [22 counts]

("peregrine falcon*") NEAR ("endangered species") NEAR (Montreal OR Toronto OR "New York" OR Columbus OR Pittsburgh) [0 counts]

We see that we have indeed narrowed our results, in one case to zero! That is because the concepts of falcon and endangered status are more closely related than the cities in which the birds might be found. We could choose to go with the first **NEAR** query, but really the results set from the simple **AND** construction still had low enough counts and the first listings met our desired results. Our conclusion: use of the **NEAR** operator may be just a bit too fancy in this case.

So, despite the fact that Boolean queries can become quite complicated with different operators that you can use, the better rule is **Keep it Simple**. As long as you try to combine two or three query concepts at the same level linked via the **AND** operator, you should be just fine in getting meaningful results.

A different kind of unintended consequence can arise from the use of the **AND NOT** operator. To illustrate this, let's take this query as our starting example:

TIP

Avoid complicated nesting with too many parentheses; they can sometimes give results you did not intend.

hawk* AND eagle* AND falcon* AND raptor* [3,065 counts]

We see, however, that we violated one of the rules of mixing redundant terms at different levels. Hawks, eagles and falcons are all raptors. So to test what happens when we pull the **raptor*** term out, we try the **AND NOT** operator:

hawk* AND eagle* AND falcon* AND NOT raptor* [10,336 counts]

But, wait, why didn't our document count go down? It went way up! Didn't we remove a term from our query?

This is a good illustration of a common misperception about operators and the universe upon which they operate. In fact, based on the left-to-right evaluation rule (absent nesting), the universe upon which the **AND NOT** operator was working in this query is:

hawk* AND eagle* AND falcon* [13,930 counts]

Thus, some 3,600 of these source documents do not contain the words raptor or raptors.

Lastly, unbalanced parentheses can be a common mistake in query formulation. All of the leading search engines that support Boolean queries test for this and give you a bad syntax error should you forget an open or close parenthesis. However, if you keep your nesting simple as we recommend, you should minimize occurrences of this mistake.

Part 8: Using Filters

Filters provide a different dimension or perspective by which you can “slice and dice” your search results. They are totally independent of the query. Filters determine the population to which a given query can apply.

Most of the major search engines support filters to greater or lesser degrees. Some also offer filter capabilities unique to themselves. For certain specialty searches or needs, you can use these unique filter capabilities to great advantage. You may want to check out the comparison chart in **Topic 38** to see how the major engines stack up and which unique capabilities they offer. You may also want to check out our solution **[Topic 48].**

Topic 30: Site Filters

Site filters allow you to limit your search universe to specific or partial specifications contained in a site’s universal resource locator, or URL. The URL is what you link to when you click on a reference in a Web document or enter a new site address in the location edit box on your browser.

TIP

Filters provide a useful complement to queries to target and restrict your results.

To use site filters effectively, you need to understand what is contained in a URL. Let’s take this one as an example, which we’ll look at in parts:

```
http://www.thewebtools.com.us/works/howitworkscallout.htm
-------- ------------------------------ -------- ----- --------------------------------------------
   1                2                3       4                  5
```

1 The **http://** is a standard prefix to all Web site addresses. You may not even see it in all cases, because if it is lacking, your browser assigns the prefix to the URL. You should ignore it when using site filters (in other words, DO NOT enter it or use it!)

2 The **www.thewebtools** is the subdomain name. It often has a **www** prefix (for World Wide Web), or it may not. You can generally ignore the **www** in any case with site filtering. The subdomain is all information that appears between the **http://** and the major domain or country name (**3** and **4**). It can sometimes appear in multiple parts, especially for larger organizations that may have multiple servers accessing the Internet. For example, for an educational institution you might see **bigserver1.mystateu** shown as the subdomain name. Most often the subdomain contains useful identifying information about the organization (**cornell**, **microsoft**, **ibm**) to search on

3 The generic, major domain name (**com**, in this case) is shown in this field. This is one of the broadest and most useful site restrictions you can apply to specialty searches. The use of generic domains is heavily oriented to United States sites. Right now, the major domain names are:

com – companies and commercial sites
edu – educational institutions
gov – government organizations

mil – military organizations
net – Internet service providers and services
org – non-profit organizations

These major domains are now being expanded to include:

arts – entities emphasizing cultural and entertainment activities
firm – businesses, or firms
info – information service providers
nom – for those wishing individual or personal nomenclature
rec – emphasizing recreation/entertainment activities
store – businesses offering goods for purchase
web – entities emphasizing activities related to the World Wide Web

4 Country domains (also known as geographical or ISO3166 domains) are the top-level domains maintained by every country and territory in the world. These domains are organized by locality, and are useful to organizations and business that wish to operate overseas OR want to protect their company or brand identity. Like generic domains, country domains are accessible to any user of the Internet. Country domains have two-letter designators, *e.g.* .**fr** for France, .**uk** for the United Kingdom, .**au** for Australia, .**us** for the United States (not generally used), etc. There are over 230 top-level geographical domains, of which about 190 currently accept domain registrations. You may obtain a complete listing of these abbreviations from **[22]**

5 All information prior to this point identifies how to get to the given physical location where the Web documents reside. Field **5** represents the path and specific Web pages at that location internal to that site. This field can contain useful information, such as **howitworks**, but is sometimes quite cryptic and often can be quite long. Note that absent a designation in this field you are generally directed to the home, index or main page of the given site. Also note that some engines that support site filtering do not allow you to search in this field.

Generally, fields **2**, **3** and **4** are the most useful to use when restricting sites. **5** is subject to much variation and is not always supported. We recommend that you only use it when you have advance information or specification of the given document(s) for which you are looking.

When using site filters, you need to be careful that you don't enter too broad a specification. For example, using '**com**' as a site filter specification would result in including sites with the '**.com**' domain as well as sites such as **commonplace.edu**, **commercial.net** or **markettips.org/commercialization.html**. Attentive use of periods ('.') and slashes ('/') can help narrow your restrictions for those search engines that support the site filtering feature.

Topic 31: Size Filters

Presently, no major search services are known to filter documents by size. There are third-party products, however, that can do so [see **Our Solution**].

Topic 32: Date Filters

Date filters can be especially useful when doing research on time-sensitive information. Depending on the engines that support this feature, you can restrict retrievals to documents modified since a certain date or within a range of dates.

Date filtering provides a good argument for keeping a record of your exact query and its date for very important searches. Then, should you want to see what results have been updated or added to the Internet since your last search, you can simply re-submit the initial query and select the appropriate date restriction.

There is a caveat to date filters, however. The dates shown used by the engines are (generally) the date the page was indexed, not created. (Date created fields are available to Web developers, but not all use them. Also, not all engines read this field, anyway.) Some search engines are running days to weeks behind in indexing pages. To prevent possible gaps in your date searches, you may want to consider moving the start date back by three weeks or so from the absolute date you want to filter.

Topic 33: Specialty Filters and Search Options

In the competitive race to provide more features, many search engines are providing specialty filters and search options. For a listing of these features by major services, see **Topic 38**; for a listing of our specialty options see **Topic 48**. Here, however, we describe what options are available. Please note these options are supported by only a limited number of services. Also note that these features may be described slightly differently by different services; consult their specific help files.

- **People's Names** – only provided by Yahoo as a specific option (use of Four11); can be accomplished with other services that support mixed capitalization. Also, though not a specific option, AltaVista will search for any name entered in place of a URL. In addition, there are special engines on the Internet specifically for finding people, such as Switchboard. See the section on specialty engines, **Topic 39**.
- **Depth** – provides the ability to retrieve additional pages from a given site; 'depth' represents the nested levels to retrieve
- **Anchor** – finds pages that contain the specified word or phrase as contained in a link. For example, 'Click here to download' could be text associated with a link. If specified with this option, documents that contain this phrase would be scored as a result
- **Applet** – identifies documents with Java applets corresponding to the name provided
- **Domain** – finds documents restricted to the country or generic domain specified
- **Host** – finds documents on the specific computer specified for 'host'
- **Image** – identifies documents with images (graphics) corresponding to the filename specified
- **Link** – finds documents with links to the URL specified as the argument
- **Title** – identifies documents that contain the word or phrase specified in their titles
- **URL** – finds documents whose URLs match the word or phrase specified
- **File/Media Types** – identifies documents which contain the file or media type specified; useful, for example, in finding documents with audio or video
- **Business Document Types** – restricts retrieval of documents to those matching the document types of press releases, product reviews or job listings.

Part 9: Understand Your Engines

Effective searching requires understanding how best to utilize the features of your search services. But, Internet searching is a highly-competitive, dynamic area. New search engines are cropping up continually, others are folding or being acquired, and feature sets change almost daily in order to keep pace.

This part is a comprehensive overview of the state of search services on the Internet as of Spring 1998. When published, it was already possibly dated. The authors therefore take no responsibility for the accuracy or completeness of the information herein. Hey, we're just doing the best job we can. But we do make mistakes ….

Topic 34: Some Caveats: The Dynamic Search Business

Searching on the Internet extends from the quick question, for which a lot of information is known to exist, to serious and purposeful research on esoteric topics. Casual users simply surfing or posing the quick question likely do not need an understanding of query syntax and construction nor search engine features and operation. This tutorial is definitely geared to those who want to spend the time to get more enjoyment and results from serious searches.

As of early 1997, some 600 search services were known to exist on the Internet. Recent citations have noted as many as 1,800 and one Web site, www.beaucoup.com, includes references to more than 1,000 **[23].** Major engines of a year ago, including Galaxy, Magellan and WebCrawler, have gone out of business or been acquired by competitors. Major partnerships have been formed – such as between AltaVista and Yahoo – and some apparently separate engines, such as AOL NetFind, are branded implementations of other services (in this case, Excite). Entirely new services, such as Snap! and the Mining Co., have also begun in the past year and achieved early prominence. The industry is clearly in flux.

This dynamism makes it impossible to keep absolutely current on the state of Internet search services. The information presented herein is a best-faith effort to provide an accurate snapshot of its state as of Spring 1998. The authors or The WebTools Company make no representations as to the accuracy or completeness of the information presented.

The authors do not intend endorsement by virtue of whether a search service is listed herein. The decision as to which engines to include as major ones comes from one of the more authoritative Web sites on search engines, www.searchenginewatch.com **[24]**. The engines included in that service were used to define which search services in this tutorial were classified as "major."

Updates of this tutorial are likely. We welcome you to identify errors or provide us additional, useful information. These updates and corrections will be reflected in future versions.

Topic 35: Duplication, Coverage and Responsiveness

Best estimates of the number of publicly-available documents on the Internet are 320 million **[3]**, though previous estimates based on information from the major search services themselves place the amount at 200 million **[25,34]**. The fact that the numbers available are simply estimates and differ by more than 50 percent is an indication of how little is truly known about the size of the Internet and the completeness with which search services cover it.

The same *Science* article by Steve Lawrence and Lee Giles of the NEC Research Institute from which the larger estimate was drawn also is the reference for much of the information on search engine duplication and coverage.

Lawrence and Giles (L&G) analyzed coverage of 575 mostly scientific or technical queries posed by researchers at their institute in December 1997. Krishna Bharat and Andrei Broder (B&B) of the Digital Systems Research Center recently conducted a similar study with nearly equivalent methodology **[34]**. Here are their findings for coverage of the Internet by six of the major services, all of which do full-text indexing (in other words, a directory service like Yahoo was not included in their analysis):

Search Engine	**% Combined Coverage**		**% Coverage of Total Web**	
	B & B	**L & G**	**B & B**	**L & G**
HotBot	48%	58%	42%	34%
AltaVista	62%	47%	50%	28%
Northern Light	---	33%	---	20%
Excite	20%	23%	17%	14%
Infoseek	17%	17%	15%	10%
Lycos	---	4%	---	3%

The combined coverage figure refers to what percentage of searches were successfully returned by that engine. Because none of the engines comprehensively covered the Internet, the percent coverage of the total Web represents the authors' estimate of gaps and overlap.

TIP

You should always use multiple search services for your important queries.

One of the main conclusions of both studies is that no search engine indexes more than about one-third to one-half of the publicly-available documents on the Internet. By applying these figures to the known documents these services have indexed, the authors were able to come up with their estimates of 200 million to 320 million total documents on the Web. Even still, the authors believed their size estimate to be a lower bound, expecting the "true size of the Web to be much larger" than their methodology suggests **[3]**.

Three additional conclusions from the L&G study deserve mention. First, submitting queries to multiple search engines greatly increases the amount of results obtainable. They estimated that combining queries to the six engines studied increased the likelihood of finding results by a factor of 3.5.

Second, they found surprisingly little duplication between the engines. With the largest two engines, HotBot and AltaVista, the number of duplicates was only 18% **[26]**.

And, third, they found that "dead links," that is pages listed on the search engines but no longer in existence, ranged from 1.6% to 5.3%. Though not universally true, there tended to be a correlation of engines that indexed more documents, such as HotBot, with a higher incidence of dead links. This result should not be surprising, in that significant effort must be expended to maintain a larger database, and the room for error and untimeliness is higher.

Of course, size is not all that matters on the Internet. Many search engines justifiably make the argument that better and more accurate beats bigger. As a searcher, your interests should be on the quality of results. What perhaps is most disturbing, then, is that many quality results may not be indexed by the major engines in use. This possible lack of coverage is likely not a concern if the search topic is one of a broad, widespread nature. But, if looking for technical information or that which is inherently not part of the mainstream, these results are not comforting.

There is perhaps a serious methodological flaw at the heart of the *Science* article analysis. Recall two things: first, the subject of the analysis was technical queries; and, second, the nature of how items get listed initially by search engines.

Full-text search engines get their listings in one of two ways. Either a site developer submits one or more Web addresses asking the engine to index it (in which case it is then scheduled for a later full-site indexing). Or, the 'spiders' used by the engines to find new content on the Web encounter the site and then include it. Spiders depend on linkages from prior sites to identify new ones. Information tucked away in the nooks and crannies of the Internet – in other words, some of the most specific information you may be trying to obtain – may have few if any links to them. Without links, or without prior notification by the developers, spiders will only chance upon new sites.

Because businesses tend to actively seek listings on search engines, it is not at all clear that the lack of coverage implied by the *Science* article would apply to this sector. By focusing on technical searches, the authors could therefore have significantly overestimated the lack of coverage on the Internet. Whether coverage is better or worse for different subject areas or for different focuses on the Web is unknown at this time.

As professional information searchers have come to well understand, individual search engines can return outstanding results that are found on no other engines **[30]**. For this reason, and the reason of inadequate coverage by those engines, you should always submit your important queries to multiple search engines.

Topic 36: Boolean or Not?

For serious searching, perhaps the most important first choice facing you is choice of search engines. Which search engines better cover the topics you are interested in? Which support the search features that will enable you to find what you want?

Not all searches are created equal. The increasing ability of some search engines to take your requests in context, and then enable you to narrow results based on your first attempt, is a promising development. Certainly being able to type in a few words and then begin receiving documents of value bodes well for common-topic searches. We ourselves use this approach when quick searches are needed.

We doubt, however, the ability of search engines in the near term to improve on this process for complicated searches or for hard-to-find information. Not only is coverage of such topics weak for a given engine, but the ability to anticipate refinements is weakened by the need to categorize information into levels insufficiently specific to the difficult query.

Thus, for difficult search topics, we still must recommend the use of search engines with full Boolean support. Only you know what information you are seeking (even though it may be ill-defined or abstract). With full Boolean searching, you have complete control to find what you seek.

This recommendation, however, exacerbates the lack of coverage of any given search engine. By definition, hard-to-find information is not well-indexed, meaning you will likely need to use more than one search engine to get the robust results you desire.

TIP

Use search engines with full-text indexing and Boolean support for your most demanding queries.

Topic 37: A Comparison of 100 Search Services

A listing comparing major features of 100 of the largest search services on the Web is shown below. For a larger listing of more than 1,000 search services, see **[23]**.

Search Service	URL Address	Boolean Operators	Results/ Page	Multiple Pages ?	Max. Listings
@BRINT - Business Research	www.brint.com	AND,OR,(),,"		No	
AlbanyNet	www.albany.net	---	10	Yes	
AltaVista UseNet	www.altavista.digital.com	---	10	Yes	200
AltaVista UseNet Advanced	www.altavista.digital.com	AND,OR,(),NOT,NEAR,",*	30	Yes	
AltaVista WEB	www.altavista.digital.com	---	10	Yes	200
AltaVista WEB Advanced	www.altavista.digital.com	AND,OR,(),NOT,NEAR,",*	10	Yes	200
American Memory Collection Search	lcweb2.loc.gov	---	20	Yes	
America's Job Bank Search Index	www.ajb.dni.us	---	200	No	200
AOL NetFind	www.aol.com	AND,OR,(),NOT,,",	40	Yes	
AquaLink	www.aqualink.com	---			40
ArchNet Archaeology	spirit.lib.uconn.edu	AND,OR,(),NOT,,",	200	No	200
BizWeb	www.bizweb.com	#	200	No	200
c|net News	www.news.com	AND,OR,(),NOT, ,”,	25	Yes	500
c|net Search.Com	www.search.com	---	10	Yes	
c|net Shareware.com	www.shareware.com	---	100		
CBS Sportsline	cbs.sportsline.com	---	25	Yes	
CNN Database	www.cnn.com	---	10	Yes	
CNNfn - the financial network	www.cnnfn.com	---	100		
CollegeNET	collegenet.com		200	No	200
Computer Gaming World	cgw.gamespot.com	---	50	Yes	
DejaNews	www.dejanews.com	AND,OR,(),NOT,NEAR,",*	50	Yes	
Discovery Channel Online Search	www.discovery.com/whatsonline/search.html	---	10	Yes	
Encarta Online	find.msn.com	AND,OR,(),NOT,NEAR,",*	50	Yes	
Environmental Organization Web Directory	www.webdirectory.com	---			
EuroFerret	www.euroferret.com/	---	10	Yes	
Excite	www.excite.com	AND,OR,(),NOT,,",	20	Yes	
Excite News Tracker	excite.com	AND,OR,(),NOT,,",	10	Yes	
Explorer-K-12 Math/Science	unite.ukans.edu	---			
Forum One - Online Discussion Forums	www.forumone.com	---			
Galaxy	www.einet.net	---	20	Yes	
HotBot	hotbot.com	---	100	Yes	
HotBot Advanced	www.hotbot.com	AND,OR,(),NOT,,",	100	Yes	

Search Service	URL Address	Boolean Operators	Results/ Page	Multiple Pages ?	Max. Listings
IBM Infomarket-Research Reports	www.infomarket.ibm.com	---	15	Yes	
Inference FIND	www.inference.com/infind/	AND,OR,(),NOT,,",*		No	
Infohiway	www.infohiway.com	---	30	Yes	
Infomine (Internet Enabling Tools)	lib-www.ucr.edu/search/ucr_enbsearch.html	AND,OR,(),",#			
Infoseek	www.infoseek.com	AND,OR,NOT,”	50	Yes	200
Internet ArtResources	artresources.com/search.html-ssi	AND,OR,(),NOT,”,*		No	
Jayde Online Directory	www.jayde.com	---	50	No	50
Lawcrawler	www.lawcrawler.com	AND,OR,(),NOT,NEAR,",*	10	Yes	
Librarians' Index to the Internet	sunsite.Berkeley.EDU	---	200	No	200
LinkMonster	www.linkmonster.com	AND,OR,(),NOT,”,*	200	Yes	
LinkStar	www.linkstar.com	---	10	Yes	
Liszt, the Mailing List Directory	www.liszt.com	AND,OR,(),NOT,”			
Lycos Pro	www.lycos.com	AND,OR,(),NOT,NEAR,",	40	Yes	
Magellan	www.mckinley.com	AND,OR,(),NOT,,",	10	Yes	
Mamma Search Engines	mamma.com	---	10	Yes	
Metacrawler	www.metacrawler.com	---	30	Yes	
Microsoft(r)	www.microsoft.com/search/default.asp	AND,OR,(),NOT,NEAR,",*	10	Yes	
Northern Light	www.nlsearch.com	---	25	Yes	
OneLook Dictionaries	www.onelook.com	---		No	
Open Text	www.opentext.com	---	10	Yes	None
Orientation.com - Asia	www.orientation.com	AND,OR,(),NOT,NEAR,",*			
PC World Online	www.pcworld.com	---		No	
PlanetSearch	www.planetsearch.com	---	10	Yes	
Point's Top 5%	www.pointcom.com	---	10	Yes	
Product Review Net	www.productreviewnet.com	---		No	
PubMed - National Library of Medicine	www.ncbi.nlm.nih.gov	AND,OR,(),NOT,”,*			
Reference.com (Mailing List)	www.reference.com	AND,OR,(),NOT,NEAR,",*	200	No	200
SavvySearch	guaraldi.cs.colostate.edu:2000/form	---			
Science Fiction Review Archives	julmara.ce.chalmers.se	---	20	Yes	
searchUK	www.searchuk.com	AND,OR,(),NOT,",*			
Social Science Information Gateway	/www.sosig.ac.uk	AND,OR,NOT,*			
Spry Internet Wizard	www.sprynet.com	---		No	
Surf Point	www.surfpoint.com	---	30	Yes	
The Sporting News	www.sportingnews.com	---			
The United Nations	www.un.org	---			
Time Magazine Online	www.pathfinder.com/time	---	10	Yes	
WebCrawler	www.WebCrawler.com	AND,OR,(),NOT,,",	25	Yes	
WebCrawler News	search.excite.com/wc	AND,OR,(),NOT,,",	200	Yes	
What's New Too!	newtoo.manifest.com	---	25	Yes	
Windows 95 Magazine Search	www.win95mag.com	---		No	
World Wide Arts Resources	world-arts-resources.com	',#		No	
WWW Virtual Law Library	www.law.indiana.edu	---	20		
WWW Virtual Library-US Government Information	iridium.nttc.edu	---	100		
WWWomen	www.wwwomen.com	---			
Yahoo	search.yahoo.com	---	20	Yes	Varies
Yahooligans	www.yahooligans.com	---	25	Yes	

Topic 38: Major Search Engine Features

Based on the rankings in Search Engine Watch **[24]**, the chart below compares features for the major search services on the Web. Included in this listing are search engines (**SE**), directories (**D**), and metasearchers (**MS**). For a further description of search service types, see **Topic 2**; for a description of the features listed, see **Topic 33**. Specific notes on some of the services are appended at the end of the table.

Some of the listed features are coded. These codes represent our judgment as to the completeness of a feature compared to other services in the listing:

y means the feature is deemed to be as complete as others

y/n means the feature is not as complete as others offered or does not provide full functionality

A blank means that service does not offer the feature shown.

As before, we do not imply endorsement nor claim complete accuracy for the features presented. You are always advised to consult the online help topics for any given services. Features and sometimes syntax change on a periodic basis.

	YAHOO	EXCITE	INFOSEEK	LYCOS	ALTAVISTA	WEBCRAWLER	HOTBOT	LOOKSMART	NORTHERN LIGHT	METACRAWLER	INFERENCE FIND
GENERAL											
Ranking by User Base	1	2	3	4	5	6	7	8	---	---	---
Type	D	SE	SE	SE	SE	SE	SE	D	SE	MS	MS
Size (Mill pages)	0.8	55	30	30	100	2	110	0.3	40	---	---
Max Pg/Request	100	50	50	50	10	100	100	10	25	30	---
STRUCTURED QUERIES											
Complete Boolean		y		y	y	y	y				
Stemming	y		y	y	y			y/n			
Case Sensitive			y		y		y/n		y/n		
Phrases	y	y	y	y	y	y	y		y	y	y
AND	y	y	y	y	y	y	y	y	y	y	y
OR	y	y	y	y	y	y	y		y	y	y
NOT	y	y	y	y	y	y	y		y		

	YAHOO	EXCITE	INFOSEEK	LYCOS	ALTAVISTA	WEBCRAWLER	HOTBOT	LOOKSMART	NORTHERN LIGHT	METACRAWLER	INFERENCE FIND
NEAR				y	y						
BEFORE				y							
AFTER				y							
'( )		y		y	y	y	y				
INDEXING											
Separate Names/Titles			y								
Metatag			y	y/n	y		y		y/n		
Title	y	y	y	y	y	y	y				
Body		y	y	y	y	y	y		y/n		
ALT Tags			y	y	y	y					
Comments			y				y				
RESULTS RANKINGS											
Relevancy	5	1	2	4	3	4	2		4		
User Specified					y						
Refining Options		y	y		y		y				
FILTERS											
Date	y/n				y		y		y/n		
File/Media Types					y/n		y				
Business Doc Types									y		
LANGUAGE CHOICES											
Language					y						y/n
Special Characters					y						
SPECIAL SEARCH OPTIONS											
People's Names	y										
Text	y	y	y	y	y	y	y		y		
Depth							y				
Anchor					y						
Applet					y		y				
Domain					y		y			y	
Host		y	y		y		y				
Image					y		y				
Link			y		y						
Title	y		y		y		y				
URL	y		y		y		y				
NOTES	YA	EX	IS	LY	AV	WC	HB	LS	NL	MC	IF

The key for how the services determine relevance is: 1 -- 3/4 star review; 2 -- metatag keywords; 3 -- title keywords, popularity; 4 -- none; 5 - in title, higher in category tree.

Specific service notes are:

YA – people searching uses the Four11 specialty engine
EX – employs 'morphological analysis' to suggest refinement words for the keywords entered into a search
IS – need to use commas to separate phrases and hyphenate words that need to appear next to one another; word within brackets are found if within 100 words of one another
LY – can specify **NEAR**, **BEFORE**, **AFTER** word distances
AV – specialized functions for usenet searches; advanced searching turns off relevancy ranking (can hand enter); allows translation from different languages
WC – can specify **NEAR**, **BEFORE**, **AFTER** word distances
HB – special search options through what Hotbot calls meta words
LS – uses AltaVista as source engine; presents results with category options for each entry; entries reviewed by editors
NL – can create custom folders, relevant to current search, that can be updated as more searches take place
MC – metasearches Lycos, Infoseek, WebCrawler, Excite, AltaVista, and Yahoo
IF – categorizes results by anticipated categories; searches are time limited; metasearches WebCrawler, Yahoo, Lycos, AltaVista, InfoSeek, and Excite.

The options shown in the table are often noted by different terms by the services that support them, and usually involve special syntax rules. Sometimes, too, the descriptions of how these features operate is difficult to find from the main pages of the services. Directly consult each service's home page; and, then, try consulting advanced or power searching, the help sections or the frequently asked questions (FAQ) areas to read about the special operators and their rules.

Topic 39: Specialty Engines

Specialty engines have the advantage of cataloging information particular to a narrow topic area, thus potentially increasing coverage versus the general search services. This advantage, however, often comes at the cost of not providing you with the search options and flexibility that the general services provide.

The most complete catalog of Internet search engines is found at www.beaucoup.com, listed below for English-oriented services, by its breakdown of more than 1,000 search engines and major topic area:

Category	Count	Category	Count
General	39	School Listings/Student Aids	20
Multiple/Meta	16	Music/Sounds	32
Media	42	Arts/Graphics	45
Country- or Region-Specific	68	Science/Nature/Technology	54
Software	43	Email/Domains/People	23
Reference	51	Social/Political/Environment	33
Language	6	Internet/WWW	37

Category	Count	Category	Count
Literature	25	Computer/Programming	43
Health and Fitness	17	Politics/Government/Law	45
Foods and Diet	19	Business/Finance/Consumer	51
Medicine	38	Malls/Classifieds	14
Hobbies/Rec/Pets/Games	51	Large Corporations	65
Employment Listers	54	Potpourri	27
Corporate Employers	46		
Educational Resources	23	**Total**	1,027

Be aware some of these services catalog information that is not normally spidered or indexed by the general search services.

Not shown on the table above are two additional categories of search services: 1) those providing searches in languages other than English; or 2) regionally-based searching. For example, major search alternatives are provided in the languages of Dutch, Spanish, German, Japanese, French, and specialty search services are offered in perhaps another 30 languages or so. For regional alternatives, Yahoo alone provides 12 different country-based search services and another 12 focused specifically on individual U.S. metropolitan areas. Similar diversification is occurring with other major search services.

These specializations are natural and reflect the huge size of the Internet (plus, obviously, the fact that English is not the only language used on the Web!). This specialization trend is likely to continue.

Depending on the topics of your searches, you are encouraged to test out and try these services.

Part 10: Specialty Searches

This part provides a compendium of tips for specialty search topics. Most of the individual topics below simply offer bulleted suggestions for ways to first approach these searches. Once used, you will likely find for yourself additional ‘power searching’ tips.

Topic 40: Product Searches

Here are some tips on finding product information:

- Use product-oriented specialty search engines (see **[23]**)
- Make sure and use the actual product name in your search; use if possible a search engine that supports mixed upper and lower case
- Join appropriately stemmed search terms using the product and known company name. For example, to find information about Mata Hari from The WebTools Company, do not enter specific version information or full company titles; these can overly restrict your results. Instead, try **mata hari AND web AND tools**
- Try limiting your searches with the **.com** filter; this will eliminate references from non-business sites (also note that some countries, such as Australia, United Kingdom and Canada, also use the **.com** site domain for commercial sites before the country domain)
- For product-related announcements, use the domain or url search options [see **Topic 33**].

Topic 41: Competitor Intelligence

Here are some tips on finding information about competitors:

- Job listing or employment sites can be a first indicator of whether competitors are growing or not. Try searching at the individual company’s site and job listing engines and monitor trends over time
- Alternatively, but less useful, is to search resume posting services to see if many employees are bailing out. Because employees in this position are generally reluctant to announce their intentions, this tactic is generally less useful than company hiring trends. One important exception: When the company itself has internally announced a staff reduction. Sudden blips in resume postings can be a valuable early indicator
- Many of the major search engines contain sections entitled ‘Company Profiles’ or a similar category. Try restricting searches to these categories
- Archive your useful queries and repeat over time. Search engines that contain a ‘CGI-bin’ name in the query produced can be saved and used again later
- Monitor business news sources [see **Topic 46**].

Topic 42: Market Research

Here are some tips on doing market research:

- For comparative market information, first try combining words or phrases that you know appear for the leading market-share companies or products. For example, in cereals, try conjoining “Rice Krispies” and “Captain Crunch”; for corporate information, try conjoining “IBM” with “Microsoft”. These should not be the ending of your query, but the narrowing beginning
- Consider using search engines that support the link, host or domain filters [see **Topic 33**].

Topic 43: Finding People

Here are some tips on finding people on the Internet:

- Use specialty engines
- Use search services that support mixed upper and lower case
- Be careful, first names are often not reliable; many individuals use initials or diminutive forms for first names ("Mike" v. "Michael" v. "M."), or may be cited by others in different ways.

Topic 44: Finding Places

Here are some tips for finding information about geographical locations on the Internet:

- Try limiting your searches by country domains
- Use regional Yahoos
- Used mixed case when searching for proper place names
- Consider using the geographic-specialty search engines
- Try using the location options in HotBot's SuperSearch mode.

Topic 45: Finding Documents

Here are some tips for finding documents:

- There is a tremendous storehouse of information not actually catalogued by search engines because the documents are not distributed as Web pages. When looking for such information, consider using meaningful document title names plus common extensions for such files (*e.g*., .PDF for Adobe Acrobat, .DOC for MS Word documents, etc.) in your queries
- Use the Anchor option in AltaVista, matched with an appropriate query dealing with your topic of interest.

Topic 46: Finding Recent News

Normal search engines and services are generally poor sources for recent news. Some of them, however, (Excite and HotBot as two examples) have separate search options for news postings that tend to work in the same ways and with the same features as the standard engines.

There are very useful magazine and daily periodical resources on the Web, notably including Time Warner's Pathfinder, USA Today, Wall Street Journal, San Jose Mercury News, etc., etc. Most of the major magazines and dailies now have a Web presence.

Another useful source for news are the 20,000 newsgroups on the Web. While news per se is not covered in a traditional way, opinions and links to breaking news sources can often be found. DejaNews and AltaVista's Usenet are good starting points.

Part 11: Summary and Further Information

The information professionals at the University of California at Berkeley recommend a graduated approach to Web searching **[31]** . Here's their stepwise sequence of steps to follow, which we generally endorse for beginning searchers:

1. Before you begin, learn how to analyze your topic and formulate your query
2. As a first pass, use a metasearcher using phrases and a relatively simple query formulation
3. As a second pass, pick the specific search engines with the specific features that best support your current query
4. As a third pass, consider directories that might contain references to comprehensive sites in your specific topic area
5. As a fourth pass, consider specialized search engines
6. Finally, use major search engines with full-Boolean logic applying the rules and lessons we've offered in this tutorial.

As you gain experience, you can begin cutting out the middle steps. By the time you're doing real heavy lifting with your queries, you really only need spend some time first getting your query right and then cutting to the bottom line with a full Boolean search using phrases and three or so concepts linked through the **AND** operator and multiple search engines.

Here's a recap of some of the recommendations made throughout this tutorial:

- Spend time BEFORE your search to **analyze what** it is **you're looking for**
- **Use nouns** in your queries – the who/what, when, where, how and why; avoid conjunctions, verbs, adverbs and adjectives
- Use **keywords at** the **right "level"** of specificity: precise, but not overly restrictive
- **Use phrases** where natural; they are your most powerful weapon
- **Use** structured ("Boolean") syntax, especially the '**AND**' **operator**
- Constrain your search by using **two** or **three** related, but narrowing, **concepts** in your query
- BUT, generally, keep overall query length limited to **six to eight keywords** maximum
- **Use advanced** search **options** and specialty features when appropriate **[Topic 48]**
- **Use multiple** search **engines for** your most **important queries** – research shows accuracy improves many-fold **[Topic 48]**
- For **difficult searches**, **use** only search engines that support **Boolean syntax**, or tools or metasearchers that do **[Topic 48]**
- For specific topic searches, consider search engines tailored to those topics
- Save time by **learn**ing **your search engines** and advanced, 'power searching' techniques **[Topic 48]**.

Useful tips for how to govern the accuracy and scope of your searches are:

Search Action	Search Scope	Results Likelihood	Comments
Focused Keywords	narrows	higher	yes; but can be too focused
Broad Keywords	broadens	lower	low yield

Search Action	Search Scope	Results Likelihood	Comments
Use of Synonyms	broadens	higher	watch for long query sizes
Additional Keywords	broadens	higher	good, if related well
More Query ‘Concepts’	narrows	higher	should not exceed 3 to 4
Fewer Query ‘Concepts’	broadens	lower	single concept or keyword MAJOR search mistake
Use of Phrases	narrows	higher	exact word order critical
Use of Wildcards	broadens	higher	recommend; watch short stems
Multiple Queries	broadens	higher	useful when search uncertain
Simple Text Search	broadens	lower	quick; same as all **OR** operators
Structured (Boolean) Search	narrows	higher	takes time to master
AND Operator	narrows	higher	highly recommended
OR Operator	broadens	lower	only for synonyms; be careful when using with **AND**
NEAR Operator	narrows	higher	excellent alternative to phrases
AND NOT Operator	narrows	higher	useful in limited circumstances
Use of Parentheses	depends	depends	great when done well; tricky to do; keep simple
Redundant Keywords	broadens	lower	use care and remove
Alternate Spellings	broadens	higher	not common; be aware
Filters	narrows	depends	can be useful or too narrow

Fondren Library at Rice University has also published useful tips on Internet search strategies **[32]**. For advanced topics, and a resource that is increasingly focusing on Web-related topics, you may want to consult *Searcher: The Magazine for Database Professionals* **[33]**.

Finally, for issues relating to search engines, their capabilities, market share and how they work, two excellent resources are VirtualPromote **[8]** and Search Engine Watch **[24]**. You may also enjoy checking out Steve Steinberg’s fascinating article for Wired on the nature of search services and the general topic of why knowledge organization matters **[29]**.

Part 12: Solutions and the Future of Searching

This tutorial has spent considerable time on all aspects related to how to search on the Internet and the search services available. What does the current state of Internet searching suggest for the future? And, are there easier ways than needing to learn all of the nuances of various search services?

Topic 47: Ruminations on the Future of Internet Searching

We do not see the demise or “death” of search engines, as some pundits have argued. Major search engines will continue to be one of the most important first access points to the Internet. The sheer growth and chaos of the Internet assures this. But there will also be twin, divergent forces toward consolidation on the one hand and specialization on the other.

We see the continued specialization and balkanization of search engines on two levels. The first level, involving the major search services, will see consolidation and specialization at very different ends of a spectrum according to the needs of various user communities.

At the broadest consumer level, one thrust will be to provide more “intelligence” to infer simple query needs. This will enable natural language querying. Services that emphasize this strategy will attempt to become “one-stop” destinations, offering much more than searching, as a means to keep visitors longer. Virtually all of the directory services now fit in this category, with Excite and others moving in this direction as well. One might call this the McDonald’s or Pepsi approach to establishing a broad, branded consumer service. Absolute coverage of the Web’s content will be less of a driver; listing positions will be based on payments, popularity and advertising support. Query simplicity will be emphasized over user control and elaborate syntax.

At the other end of the major search service spectrum will be full-text engines, with full Boolean support and many filter options, to serve the information-intensive user community. Great emphasis will be placed on expanding the Web’s coverage by these services. The revenue model here may be advertising revenues from firms targeting this demographic, or providing demonstrations of advanced technology (Digital’s original motivation in establishing the AltaVista service). The experiment of Northern Light to provide “special” information on a subscription basis may work well for business users; we have doubts whether this is a sustainable revenue model for educators, students and others with strong information needs.

The second level, an opening created by today’s inability for the major services to cover the Web, will likely be the fastest growing category. This level is the specialization of engines by major topic area – law, science, medicine, business, etc. – to serve those specific communities. We see much consolidation occurring in each of these niches, even while the importance of the niche expands. Adding proprietary content, and the possible aggressive entries of traditional search database firms such as Dialog and Lexis-Nexis, should keep specialty topic searches an area of ferment for some time to come.

The bridging “glue” to tie all of these disparate pieces together will be the metasearchers, either Web-based services or dedicated desktop tools. It is quite conceivable, indeed likely, that Web-based metasearchers will partner with the specialty topic services to broaden their current offerings beyond the six or so major search engines that they now cover. This would free the specialty services to focus on the topics they already understand, while giving the consumer more of a single-entry point into the Web's entire content. The role of the metasearchers will be to provide de facto standardization to Internet searches.

Topic 48: Our Solution

Our solution to effective searching of the Internet is a single tool that provides one access point to Internet search services with complete query power and the ability to speak all dialects of "search engine." **Mata Hari**™, from The WebTools Company, is an advanced desktop search tool that uniquely combines these features:

- **metasearching** – **Mata Hari** is a universal translator for all dialects of "search engine." It can simultaneously search 120+ services at one time using a single and simple query format. **Mata Hari** ends the search service Tower of Babel
- **full-text-indexing** – after removing all duplicates, Web documents that meet the query specifications are fully indexed by **Mata Hari**. This means that all of the power within the **Mata Hari** product via full Boolean searches and robust filter capabilities can be applied to every single search service on the Web, whether those services natively support these features or not
- **features and filters** – a complete set of user-controllable filters can limit searches based on time, document size and date and site characteristics and name
- **fast retrievals** – a multi-threaded design enables **Mata Hari** to establish up to 120 simultaneous connections to the Internet, resulting in extremely fast document retrievals and background or offhours searching
- **multiple scoring methods** – unlike individual services or other metasearch products, **Mata Hari** provides five different ways to score documents for relevance, including a "more like this" (reranking) option that scores results based on documents containing the results you want
- **local, desktop database** – all documents returned by an initial search are stored on the desktop. **Mata Hari** is thus perfectly suited to the strategy of successively narrowed searches that information professionals recommend. Moreover, these subsequent searches are done at the much higher speeds of the local computer, eliminating the delays and bottlenecks of Internet retrievals
- **advanced set manipulation** – single to multiple terms, engines, queries, scores, or documents can be used for narrowing and manipulating results, using either **AND** or **OR** operators. And, after selections have been made, you can re-generate the terms lists applicable only to those results
- **publish and share results** – you can send a partial or complete list of results to friends and colleagues as a Web page, or you can distribute your databases or search configuration specifications.

Once you learn how to use **Mata Hari** you've learned how to squeeze the most out of the Internet. And, for those in a hurry and new to searching, just use **Mata Hari**'s simple text searches.

You can learn more about **Mata Hari**, or download a fully-functional copy for a 30-day evaluation, at The WebTool Company's Web site:

http://thewebtools.com/

Notes, Links and References

References and notes used in this tutorial are:

[1] Term counts used in this tutorial are based on the AltaVista Advanced Search option [http://www.altavista.digital.com/cgi-bin/query?pg=aq]. Actual term counts were obtained by posing the query indicated using the 'Give me only a precise count of matches.' checkbox on this page. Term counts were taken on April 24. 1998.

[2] The directory engine used for this tutorial is Yahoo! [http://www.yahoo.com/].

[3] S. Lawrence and C.L. Giles, "Searching the World Wide Web," *Science* magazine, v. 280, April 3, 1998, pp. 98-100.

[4] US Department of Commerce, "The Emerging Digital Economy," April 15, 1998.

[5] Georgia Tech's 8th Graphic, Visualization and Usability Survey, http://www.gvu.gatech.edu/user_surveys/survey-1997-10/

[6] *Ibid*.

[7] See http://www.beaucoup.com/

[8] One of the best discussions about metatags can be found on the Virtual Promote site: http://www.virtualpromote.com/metatag.html

[9] If you'd like to see these hidden tags on a given Web document, save the document while viewing in your browser using the 'Save As' option on your browser's 'File' menu option. Then, view that document with a text editor or Wordpad. You will see these hidden fields shown in HTML brackets (e.g., <Description= …>).

[10] These terms were coined by Barbara Quint; see further:
http://www.state.nj.us/statelibrary/quest01.htm
http://www.onlineinc.com/pempress/secrets/ch16.html

[11] This article presents results of searching on conventional search databases, such as Dialog, versus the Internet: http://www.infotoday.com/searcher/feb/story1.htm

[12] See http://niko.unl.edu/bs101/notes/lecture19.html

[13] Encarta 96 Encyclopedia, Microsoft, c. 1995

[14] The Original Roget's Thesaurus, St. Martin's Press, 1962.

[15] University of Minnesota Raptor Center, http://www.raptor.cvm.umn.edu/

[16] See http://www.delphy.co.kr/sub/sub-a3/logic.htm

[17] Based on using the ranking option for all search keywords in the order shown in the query.

[18] See http://www.afternet.com/~teal/falcon.html

[19] See http://www.deev.com/falcons/live-falcons.html

[20] See http://www.dnr.state.oh.us/odnr/wildlife/publications/peregrine/falcon.html

[21] See http://www.wwfcanada.org/facts/peregrin.html

[22] A complete listing of country two-letter domain codes can be found at: http://help.hotbot.com/faq/domains.html

[23] See http://www.beaucoup.com

[24] Search Engine Watch is a very useful, authoritative site on all aspects of search engines. It is found at: http://www.searchenginewatch.com. Highly recommended.

[25] This estimate is based on interviews with the technical officers for major search engines and [3]; see also the same Search Engine Watch site, http://www.searchenginewatch.com

[26] This calculation is based on information presented in Figure 2 of reference [3].

[27] G. Salton, Automatic Text Processing: The Transformation, Analysis, and Retrieval of Information by Computer, Addison Wesley, 1989

[28] B. Pinkerton, “Finding What People Want: Experiences with WebCrawler” found at: http://info.webcrawler.com/bp/WWW94.html

[29] The Steinberg article may be found at: http://www.wired.com/wired/4.05/features/indexweb.html

[30] See further, S. Feldman, “Just the Answers, Please: Choosing a Web Search Service,’ Searcher magazine, May 1997, at http://www.infotoday.com/searcher/may/story3.htm

[31] “Searching the World Wide Web: Strategies, Analyzing Your Topic, Choosing Search Tools,” issued by the Teaching Library Internet Workshops from UC Berkeley, found at: http://www.lib.berkeley.edu/TeachingGuides/Internet/Strategies/html

[32] See http://www.rice.edu/Fondren/Netguides/strategies.html

[33] See http://www.infotoday.com/searcher/srchrtop.htm

[34] See http://www7.conf.au/programme/fullpapers/1937/com1937.htm