An evaluation of help mechanisms in natural language information retrieval systems

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Abstract

The field of natural language processing (NLP) demonstrates rapid changes in the design of information retrieval systems and human-computer interaction. While natural language is being looked on as the most effective tool for information retrieval in a contemporary information environment, the systems using it are only beginning to emerge. This study attempts to evaluate the current state of NLP IR systems from the user's point of view: what techniques are used by these systems to guide their users through the search process? The analysis focused on the structure and components of the systems' help mechanisms. Results of the study demonstrated that systems which claimed to be using natural language searching in fact used a wide range of information retrieval techniques from real natural language processing to Boolean searching. As a result, the user assistance mechanisms of these systems also varied. While pseudo-NLP systems would suit a more traditional method of instruction, real NLP systems primarily utilised the methods of explanation and user-system "dialogue".

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Introduction

Every Internet or database searcher today must be a computer programmer. This is because every searcher has to explain to an information retrieval system (IRS) what he/she is looking for, and do so in a way that would be recognised by the system: keywords, Boolean operators, contractions, etc.

But recently (since the implementation of the first statistical IRS), there has been a movement in information retrieval (IR) towards the viewpoint of the user. This new trend is known as "natural language processing" (NLP) with the assumption of using NLP to enable a system to communicate with a user by means of natural language.

This research focuses on the help mechanisms implemented by NLP systems in order to assist their users in the searching process.

Statement of the problem

Does the search engine always retrieve what the user wanted? Many times it does not for several reasons, including: an imperfect query by the user; ambiguity or lack of conciseness of the query's meaning; and then, of course, the difficulty of query interpretation by the computer.

To address most of these problems, an IR system has to have an interface component to assist users with effective searching. "The help mechanism is a key component of an online system" (Xie and Cool, 2000). There exists a standard set of "help" techniques used by traditional IR systems. Among these are instructions, relevance feedback (document ranking), query expansion, etc.

Do these "help" techniques remain unchanged in the NLP environment? Are there any new techniques specific to the user assistance mechanisms in this new environment?

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In order for us to answer these questions we should first take a look at the principles according to which a natural language IR system operates.

Natural language processing: definition and techniques

According to Tolle and Chen (2000), "the object of NLP is to make the computer a fluent user of ordinary (human) language".

Recently the number of full-text (read: natural language) documents stored in databases has increased dramatically. At the front end of a system is its interface, which "connects" the system to its user, whose main way of communication is the natural language. Currently, natural language is being viewed as an ideal "knowledge representation" system, the main tool of information "storage" and communication (see, for example, Iwanska (2000)).

Natural language becomes the preferred mode of operation for two of the three key components of a modern IRS: document storage and interface.

The third component of an IRS is the retrieval mechanism itself: a set of tools allowing the system to extract and deliver information to the user. When both product storage and the interface of a system operate using natural language, it is logical to construct the retrieval mechanism using the same tool. This conclusion is obvious for many IR specialists.

These scholars also know it is only numbers that computers understand. Therefore, the problem here is the computer's inability to understand human language, to understand the meaning of a text – either written or spoken.

Language is not a "formal system" (or "logistic system"), where a sign ("symbol") has only one meaning. Every element of language – phonemes (invariants of the sounds of speech), morphemes, words, sentences, text segments – has multiple meanings. This is the way our minds work. Artificial intelligence (computers), on the contrary, is able to operate only with the system where one sign has a single meaning.

In order to enable computers to operate with a text, the text has to be structured by an IRS so that relevant meanings of the text can be extracted. NLP is a complex task involving analysis of the structure of natural language because language can be analysed on several levels (phonetic or phonological, morphological, syntactic, semantic, discourse, and pragmatic). NLP techniques include syntactic analysis (syntactic parsing), semantic analysis (semantic parsing and semantic mapping), discourse analysis, and concept matching (see Brill and Mooney, 1997).

NLP and user assistance

A major intention behind NLP is to make an IRS closer to a user (traditional IR techniques have often been referred to as "not intuitive") (see, for example, Basch (1994) for a human to use; natural language does not have to be learned by a user, as opposed to a conventional Boolean logic-based IRS, where learning of Boolean principles (at least some of them) is required in order to operate the system. But, being "intuitive" for a person, natural language is not entirely "intuitive" for a machine.

Boolean-based IRSs are always equipped with a more or less extensive help mechanism, assisting the user with query formulation and searching. It is our understanding that NLP systems should also be equipped with an appropriate help feature – one that would both explain to a user the capabilities of this particular system and guide him/her through the searching process. We should keep in mind, however, that no NLP system uses all NLP techniques, and that they also vary from one IRS to another.

Constructing a help mechanism for a NLP system is a complicated task because an ordinary human being is not familiar with the terminological body of linguistics, especially with that of computational linguistics. But a concise and practical assistance mechanism is essential for the interface of any database. Unfortunately, "NLP systems are rarely explained in natural language" (Feldman, 1996).

It should also be noted that, because of the implications of NLP, the user's demands of a NLP IRS are naturally higher: "you speak my language, ergo you understand me completely".

The focus of this study is on the user assistance component of the natural language interfaces in databases (including Web search

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engines). "NLIDB is a system that allows a user to interact with a database by expressing himself in a natural language such as English or Español . . ." (Hutchison, 2001). In order to facilitate interaction between the system and the user, the interface "provides information about the system, about what it does, and about what the user can and should do. It enables the user to learn about the system and to build an understanding of how it works" (Ravden and Johnson, 1989). The authors of *Evaluating Usability of Human-Computer Interfaces* present a set of criteria for evaluating a system's interface. Especially interesting is the category of explicitness: "Explicitness helps to make the interface 'transparent' to the user" (Ravden and Johnson, 1989). At the same time, as has been noted in the literature, "most designs for natural language interaction do not provide information about task actions and objects; users usually presented with a single prompt that invites a natural-language statement" (Shneiderman, 1998).

User/system interaction: dialogue

Most of the NLP takes place "behind the scenes", i.e. behind the interface of a system. The only exception is the dialogue between a system and its user, or what Hutchison (2001) calls "feedback". "This feedback should include confirming its (the system's) understanding of the user's query, informing the user of the user's misunderstandings and interpret null answer", and getting "the user to elaborate an ambiguous question".

Because "supporting and taking advantage of the interaction of the user with the other components of the IR system is crucial for effective IR system design", "the human-computer interaction in information-seeking strategies can be modelled as a dialog, and should be implemented as such" (Belkin and Cool 1995).

While many databases and search engines invite users to interact with them using natural language queries, not all of them employ NLP as a method of information processing and retrieval in particular. " . . . (F)inding real examples of NLP may be confusing. Many searchers have mistakenly assumed that anything labeled "natural language" uses the full range of NLP capabilities. This is rarely true, particularly in the competitive Web search engine area" (Feldman, 2000). Many databases and search engines, allowing users to search in natural language, use statistical and probabilistic techniques of IR, which is only halfway between Boolean and real NLP.

Feldman (1994) wrote in her discussion of NLP that "new search engines rank documents in a database according to predicted relevance for a specific query. Relevance ranking uses statistical algorithms . . . ". As we can see, this seven-year-old interpretation of NLP is far from the much more complex recent approach to the problem. It is worth adding that new NLP is about structuring and interpreting the meaning of the text, not just performing arithmetical (Boolean and statistical) or trigonometrical (probabilistic) functions.

Still, the end-user has very little information to determine whether a database/search engine representing itself as a NLP system actually uses any NLP at all. "NLP systems are rarely explained in natural language. The relevance ranking and weighting algorithms are proprietary" (Feldman, 1996).

Research questions

- How does an IRS present itself as one that supports natural language searching?
- What NLP techniques are used by a system and how are these techniques explained to a user?

Research design/methodology

Using exploratory research, this study examines the current state of help mechanisms that natural language search engines employ in order to assist their user in finding the information most relevant to his or her search. Since the user of a natural language system only encounters the user interface, this interface plays a significant role in the way the system is utilised. There are certain criteria that should be met in the design of any help mechanism, but because the expectations of the user of a natural language search engine are higher, the help features must also meet a higher standard. In this study, the evaluation of help mechanisms looks at the following criteria, adapted from Ravden and Johnson (1989):

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- visual clarity;
- explicitness;
- informative feedback;
- error prevention;
- user guidance and support.

These criteria were examined with an appraisal of the structure and components of the user assistance mechanism in these natural language-based search engines and databases. This appraisal was accomplished through a method of observation and evaluation using existing information available within the search mechanism itself. For example, the search engine should have a help button or link prominently displayed within or near the search query window where the user can obtain assistance with a click of the mouse.

The analysis was broken down into two sections: pre-search evaluation, which was broken down into two further areas of evaluation (structural analysis and component analysis); and post-search evaluation.

Pre-search (how to search a database)
In the pre-search evaluation, areas that were examined included such things as: is the system clear in its instructions? Is the search mechanism intuitive? Is help readily available to the user?

- The structural analysis examined the number of levels of user assistance in each search mechanism where each mouse click, or information screen, is considered a new "level".
- The component analysis examined the different elements making up the help mechanism. What elements are present at the different levels of assistance? For example, at which level would the user find illustrative examples? Another aspect of this analysis includes the terminology used in the help mechanisms, and at what levels technical terms are used; did the user need a help mechanism to understand the terminology as well?

Post-search (how to refine the search)
In the post-search evaluation, areas that were examined included such things as: did the system engage the user in a dialogue to clarify his/her search meaning or narrow down what it perceives as relevant hits? If a null answer was encountered, did the system explain why this occurred?

Data collection

Several commercial, Web-based search engines and proprietary databases were selected based on the following criteria:

- the use of natural language searching must be promoted or made apparent to the user;
- the database must have a usable help feature or instructions that explain the search mechanism/interface.

These search engines and databases were found through two chief sources: a review of current literature covering the subject of NLP and IRSs (this also includes product reviews); and through exploring the Web, utilising commercial search engines such as Google.

A predetermined set of two natural language questions was also created to test the search mechanism of these databases and search engines. One of these questions was structured to ensure a relatively high number of results or hits. The other question was structured to ensure a zero hit or null result. The purpose of the latter question was to test whether the system will offer the user assistance in reformulating his/her question.

Search engines of the following IR systems have been evaluated:

- *Internet search engines*: Ask Jeeves, heySmarty, ixquick, Netscape Search, Northern Light, One2seek, and WebCrawler.
- *Databases.* EBSCOhost, Electric Library, *Encyclop dia Britannica*, Her Majesty's Stationery Office, Infotrieve, JHPIEGO, and ProQuest.
- *Commercial Web sites*: Answer Logic, Artificial Life, epixtech, NetReach, Oingo, and PhotoDisc.
- *Experimental search engines*: GeoQuery and START.

This sampling of 22 sites is representational of other similar sites that were discovered during the initial information-gathering segment of this study. It would have proved redundant to include the superfluous Web sites in this study. See the Appendix for a listing of the NLP systems and their URLs. Below, we present a sample evaluation.

Artificial Life (www.artificial-life.com)
Artificial Life is a designer and distributor of software, particularly NLP products.

Pre-search analysis
Level I. As the user clicks through the introduction page, he/she gets to the index page that consists of three frames; the number of frames remains unchanged at all times. The top frame contains an animated agent: a cartoon of the upper part of the body of an attractive human-like female. This agent has a limited number of gestures and facial expressions (such as occasional blinking) that are activated throughout the dialogue. To the right of the agent is a query window, and the agent's phrases appear below it. The search is activated by pressing "enter".

The frame in the top left corner of the screen contains the Web site's menu that changes in accordance with the context of the "conversation".

There are no help or explanation features, or links to them, located immediately on this page. The agent is completely trusted with assisting the user. As soon as the page opens the agent introduces herself: "Hi, I am Luci. Welcome to Artificial Life, Inc."

Level II. Still, the user has a way to learn how the Web site's search engine works. Since this Web site sells NLP products, information about the search engine can be accessed by clicking on the products link on the site's menu. This takes the user to a page listing the company's products. At the same time, Luci encourages you to "Take a look at our wonderful products!", and another link appears on the menu: technology.

Level III. This level can be accessed by clicking on the technology link. This is an intermediary level that contains links to three major technological aspects of the company's products.

Level IV. This next level contains a page that explains the basics of ALife technology. The functionality of the SmartEngine is "based on several intelligent modules that include natural language understanding and processing". The main technological element here is human-computer communication in the form of a dialogue.

Level V. Clicking on the ALife-SmartEngine features link, located at the bottom of the page, takes the user to a list of technological solutions used by the creators of the program. Among the key features of the SmartEngine are those directly related to NLP: dialogs; context sensitivity; semantic mapping of topics; platonic object definition; side-by-side multilingual knowledge-base construction.

Post-search analysis
Any text entered into the query window activates a conversation with Luci. When asked: "Tell me about your company", Luci says, "We are applying artificial life technologies to solving business problems, especially on the Internet", and the products page comes up on the screen.

Luci is practically impossible to confuse. She can carry out a conversation on a variety of topics, eventually bringing a dialogue to the point where she offers the user an opportunity to learn more about the company's products (we should remember that she is a sales person). In the rare case when Luci gets confused, she acknowledges that there are questions to which she does not know the answer; the reply itself is not a dead end, but part of the conversation.

Evaluation
The AL's help mechanism is a combination of the dialogue with an agent that guides the user through the search process by responding to the user's activity and the explanation of the principles by which this IR system operates.

Information about advanced NLP technology used by the Artificial Life is easily available for the user and potential buyer. The use of terminology is moderate; most terms used for explanation are clear and all of these terms are explained themselves. At the same time, this explanation is not linked directly to the Web site's search engine (which again may be viewed as a way to avoid redundancy: the whole Web site is about search software). The animated agent/sales representative, who engages the user in a conversation, handles all assistance. This technique proves to be highly effective, and the search process produced relevant results.

Data interpretation

All data interpretation is based on analysis of the 22 online natural language search engines previously examined. Because the nature of the collected data is often ambiguous (just like natural language itself), the method of free interpretation was preferred by the author. No strictly statistical analysis has been used.

All of the evaluated search engines, at one point or another, let their users know that their systems are able to handle natural language queries. As a rule, natural language searching is offered as a basic (default) or the only option. Not all of the analysed systems use the term natural language at the search point (query window). As can be seen in Table I, some systems invite the user to "ask a question", while others say "type in a phrase or a sentence". Such suggestions provide a clue that the user does not have to utilise a complex, algorithmic (Boolean) search syntax.

Several systems did not advertise their ability to process natural language queries right at the search point. In these cases the user learns about such capability only from a Help screen (see, for instance, Northern Light or WebCrawler).

The search activation button is a small but interesting detail of the search screen. Traditionally, it is named "Search" (or submit), which was also the choice of most of the analysed systems. But some of the natural language systems named their search activation button "Ask", "Ask a question", or "Answer", as can also be seen in Table I, seemingly to contribute to the dialogue aspect of the natural language query.

Several systems have utilised a cartoon character that helps to personalise a system, thus adding a "natural" aspect: a helpful butler (Jeeves), a smart schoolgirl (heySmarty), and a pretty woman ("Luci", Artificial Life). The psychological motivation behind such a technique is rather clear: most people would "talk" to a person, but would feel uncomfortable "talking" to a machine.

Five of the main techniques used by the NLP IR systems are:

(1) semantic parsing (of a word);
(2) syntactic parsing (of a sentence);
(3) semantic mapping (of a sentence);
(4) concept matching;
(5) dialogue (an interactive feature).

The first four of these techniques are used behind the system's interface, while the last one is part of the interface design. Table II is a cumulative table of the examined NLP search engines.

There are two major, distinguishable types of user assistance/help mechanisms provided by the analysed NLP systems: instruction and explanation. Both of these methods attempt to give the user necessary information to best

Table I Elicitation mechanisms: instructions and search activation buttons presented to user with query window

Search engines		Instructions	Button
Internet search engines	Ask Jeeves	Have a question? Just type it in and click Ask!	Ask
	heySmarty	Ask heySmarty a question	Ask?
	ixquick	None	Search
	Netscape Search	Search the Web or ask a question	Search
	Northern Light	None	Search
	One2seek	None	Search
	WebCrawler	None	Search
Databases	EBSCOhost	Type a phrase or sentence, which describes what you are looking for	Search
	Electric Library	None	Search
	Encyclopædia Britannica	Enter a word, phrase, or question	Search
	Her Majestry's Stationery Office	You may use the box below to enter your natural language search terms	Search
	Infotrieve	Enter a natural language or Boolean search	Search
	PhotoDisc	Enter the word or words you want to search for below	Search
	ProQuest	Enter your question	Search
Commercial Web sites	AnswerLogic	Ask a question about AnswerLogic	Answer
	Artificial Life	None	None
	epixtech	Enter your search word(s) or phrase	Search
	JHPIEGO	Phrase your question in plain English!	Ask
	Netreach	None	Submit
	Oingo	Enter search criteria	Search
Experimental search engines	Geoquery	None	Submit
	START	Submit your query here! (A full English question, not keywords)	

Table II Natural language processing techniques as a part of the user assistance mechanisms in online search engines

Search engines		Natural language processing techniques (as presented to the user)	Interactive feature
Internet search engines	Ask Jeeves	*Syntactic parsing*	Contextual query modification
		Data mining (i.e. concept matching)	Non-contextual
	heySmarty	N/A	N/A
	ixquick	N/A	N/A
	Netscape Search	N/A	Non-contextual
	Northern Light	N/A	Non-contextual
	One2seek	N/A	Non-contextual
	WebCrawler	N/A	
Databases	EBSCOhost	N/A	N/A
	Electric Library	Syntarctic parsing	N/A
	Encyclopædia Britannica	*Syntactic parsing*	Contextual query reformulation
		Semantic parsing	N/A
	Her Majesty's Stationery Office	N/A	N/A
	Infotrieve	N/A	N/A
	JHPIEGO	Syntactic parsing	
	ProQuest	Syntarctic parsing	Non-contextual
Commercial Web sites	AnswerLogic	Concept matching	Non-contextual
	Artificial Life	*Semantic mapping*	Contextual "dialog"
		Concept matching	
	epixtech	Syntactic parsing	Non-contextual
	NetReach	N/A	N/A
	Oingo	*Syntactic parsing*	Contextual query reformulation
		Concept matching	
	PhotoDisc	N/A	Non-contextual
Experimental search engines	Geoquery	*Syntactic parsing*	N/A
	START	*Concept matching*	Contextual "dialog"
		Syntactic parsing	

Notes: N/A indicates "not available"; only NLP techniques mentioned and/or explained by a search engine are included in the table; NLP techniques that are actually used by a search engine appear in italics (see discussion below)

utilise the system's capabilities. All IR systems analysed here used either instruction or explanation or their combination to address the user assistance task.

Instruction (search tips) has traditionally been used in Boolean-based IRSs. In case of NLP systems, the most common instruction is to "use plain English" or to "ask a question as you would ask a friend". This is a situation when the user only needs to know what to do because he/she does not need to learn how to do it: everybody knows how to ask a question.

There are also more specific instructions. Some NLP search engines ask the user to enter as many words as he/she can, to get more relevant results (this is a clear sign that there will not be any NLP – only keyword searching). Ask Jeeves suggests its users enter simple questions, asking one thing at a time. Some systems also recommend making sure words are spelled correctly.

As a rule, the more detailed the instructions are, the less NLP is used by a system: if a system depends on how an inquiry is expressed (not just what is expressed), that suggests the system cannot analyse the meaning of a query.

Explanation is another type of user assistance used by NLP systems. The user is given information about how a system operates: what kinds of NLP techniques are used by the system. Understanding these techniques should assist the user in getting better results and interpreting these results correctly, which is supposed to increase effectiveness of the search process.

It is in the case of true NLP systems, when the explanation becomes complex, that the help mechanism acquires additional layers of information (our conventional levels of complexity). The only major drawback found in this type of help mechanism is the complexity of navigation. A system should make "help" easily accessible and keep it localised so that the user does not have to click on link after link to find some important assistance information.

Even though some systems claim to use certain NLP techniques and explain these to the user, these systems may not actually be using such techniques. This kind of disagreement between theoretical and practical aspects of the examined search engines has become apparent from results of the searches run in the process of data collection. Sometimes a system, claiming to use, for instance, "syntactic parsing" (i.e. analysis of the sentence structure), would end up counting the appearance of query terms in a document. As a result, retrieved documents were irrelevant to a search. This would hardly be possible if any NLP was used. Another symptom of keyword searching, instead of the advertised NLP, is a characteristically statistical technique known as "query term highlighting". Needless to say, any NLP technique explanation offered by a pseudo-NLP system is misleading and hardly helps to understand the searching process.

As demonstrated in Table II, most of the analysed search engines did not use real NLP. Even though they asked the user to enter a question or a sentence in plain English, these systems were unable to operate with the meaning of such a query. In other words, their natural language appearance is used to hide their free-text (unstructured query) keyword searching. Such systems probably used the term "natural language" to attract potential users.

Systems that provided their users with information about specific NLP techniques usually did not overload this information with heavy terminology and tried to explain the meaning of the terms in a brief phrase or sentence. On the other hand, experimental search engines and commercial distributors of NLP products provided a vast amount of information about the way a system operates and sometimes even gave additional general information about NLP (for instance, AnswerLogic). Such explanations often contained heavy terminology and were hard to read for an average user. If was also interesting to see how the sellers of NLP software (Artificial Life, AnswerLogic, Oingo) tried to advertise their products to potential buyers (who would be the main users and searchers of these sites) without revealing any proprietary technological information.

The most common way for natural language communication is dialogue. In the case of NLP systems the dialogue is a part of their user assistance mechanism – a part of the interface. This NLP technique was classified as the interactive feature of a system. Table II demonstrates that not all the examined natural language systems used such a feature. Some of these systems did not offer a query reformulation option and would not even provide any help in null result scenarios when the system was unable to retrieve any information.

Other systems provided non-contextual interaction, i.e. made suggestions or gave instructions that were not related to the meaning of the query, such as "use most important words about your topic" (ProQuest).

Several systems used more advanced, contextual types of interaction:

- *Contextual query modification*. Ask Jeeves asks the user to choose from questions (similar to the query) to which it already "knows" the answers.
- *Contextual query reformulation*. Users of Oingo and *Encyclopaedia Britannica* have the option of modifying (specifying) the meaning of the query.
- *Contextual dialogue*. Users of Artificial Life may chat with its salesgirl, Luci, as long as they do not mind her occasionally offering to show them more about the company's NLP software; chat capabilities of START are more limited: to enter a new question the user must go back to the search page.

As can be seen from Table II, the search engines employing real NLP would, as a rule, also provide their users with a contextual interactive feature.

Conclusions

NLP is a quickly developing area of artificial intelligence. Despite the fact that most of the

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analysed natural language searching systems did not utilise any NLP, several of the examined systems demonstrated the ability to work with the meaning of the user's query. The use of advanced NLP techniques (such as semantic parsing and mapping, and concept matching) not only increased the relevance of the retrieved information, but also greatly enhanced interaction between the system and its user.

Unlike statistical/probabilistic ones, true NLP systems used dialogue not just to narrow the topic of a query down to information the system was able to provide, but also to expand or even modify the meaning of the initial query. This is why, today, NLP appears to be the best available solution for IR in large databases, such as the Internet or online encyclopaedias.

Unlike more traditional Boolean- and keyword-based search engines, natural language searching systems are largely unfamiliar to searchers. Therefore, a major task for designers of natural language interfaces is to provide assistance to those using this new type of IR system.

Traditionally, users of IR systems were given instructions on how to formulate a query so the system could retrieve the needed information. Many of the analysed natural language search engines have chosen instruction as the main help technique. One of the reasons for such a choice was the fact that most of the examined systems, although promoting natural language searching, utilised statistical keyword searching. Thus, instructions for use of these systems guided users through keyword, not natural language, searching.

Research demonstrated that the only kind of instruction applicable to natural language searching was the phrase, "Ask a question in plain English" (with variations, such as "type in a sentence", etc.). But such a phrase is not effective as an instruction because everyone knows how to ask a question in "plain English". In case of true NLP systems, when a user is not restricted to specific rules of query formulation, instructions appear to be useless: the searcher types in a question and the system does the rest. This is why true NLP systems have given preference to the explanation of the principles on which the system is operating.

It is important to note that Boolean- or keyword-based search engines do not provide an explanation on how they operate. Searchers are never given insight into the nature of Boolean logic or peculiarities of vector-space models. Thus, designers of natural language interfaces are facing a new challenge: to explain to a user the ways an NLP system operates. How to do it? How much information to provide? How much terminology to use? More importantly, how to make this explanation helpful for a user.

In evaluating natural language search engines, different approaches to these problems were seen – from brief paragraphs to extensive, multi-level explanatory bodies. Despite these differences, all creators of the analysed natural language interfaces seemed to agree on the fact that an explanation (even basic) of the IR aspects of a NLP system was necessary. A NLP system should not be a "black box" for its user because machines work differently from the human mind, and, in the case of natural language searching a user may be deceived by the concept of the system's ability to "understand" the meaning of a natural language statement. The searcher must know the advantages and drawbacks of a system in order to use it effectively. Such information helps a user to understand the IR process and results of this process. Of course, how much a user should know about a particular system needs to be determined in each particular case.

Designers of natural language interfaces should also utilise the full potential of the interactive component of an interface. An NLP system should "keep in touch" with its user at all times, providing him with multiple points of interaction and information access. Dead-end situations are harmful to the search process. NLP techniques allow design interfaces that can engage a user in a productive dialogue with the system. Such flexible, highly interactive natural language interfaces would help to facilitate the search process.

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Appendix. NLP systems and their URLs

Internet search engines

- Ask Jeeves http://www.ask.com
- heySmarty http://www.heysmarty.com
- ixquick http://www.ixquick.com
- Netscape Search http://search.netscape.com/toplevel.tmpl
- Northern Light http://www.northernlight.com
- one2seek http://www.one2seek.com
- WebCrawler http://www.webcrawler.com

Databases

- EBSCOhost http://ehostvgw.epnet.com
- *Encyclop dia Britannica* http://www.ats.wilmore.ky.us:8080/
- Electric Library http://www.elibrary.com
- HMSO http://www.hmso.gov.uk/cgi-bin/empower?DB=reshmso
- Infotrieve http://www3.infotrieve.com/search/databases/search.asp
- JHPIEGO http://www.jpiego.org
- ProQuest http://proquest.umi.com/

Commercial Web sites

- Answer Logic http://www.answerlogic.com/main/index.html
- Artificial Life http://www.artificial-life.com
- epixtech http://www.epixtech.com/search/
- NetReach http://home.netreach.net/Support/askaquestion/default.htm
- Oingo http://www.oingo.com
- PhotoDisc http://search.photodisc.com/am/src/pdipower.asp

Experimental search engines

- GeoQuery http://www.cs.utexas.edu/users/ml/geo.html
- START http://www.ai.mit.edu/projects/infolab/