Effect of Extending the Scope of Search Concepts on the Intersearcher and Intrasearcher Consistency

Mirja Iivonen, University of Tampere, Finland

Abstract: The effect of extending the scope of search concepts on the intersearcher and intrasearcher consistency is considered. The scope of the search concept was extended on the basis of controlling the semantic relationships between search terms. The study is based on the empirical data where 12 searchers analyzed eight search requests and selected search concepts and search terms for a search in a certain Finnish database in two separate test situations. Both intersearcher and intrasearcher consistency grew most with a rather simple evaluation of forms of search terms. The controlling of hierarchical, associative and coordinative relationships no longer affected consistency figures so much.

1. Introduction

We people are - fortunately - different, and we also use words in very different ways, even when talking about the same topics. This principle of difference, which makes our lives rich and pleasant, makes, however, information retrieval in present information retrieval systems a very uncertain process. We cannot be sure if we match others dealing with the same topic.

According to previous studies (Fidel 1985, Saracevic et al. 1987, Saracevic & Kantor 1988, Iivonen 1992) we already know that there is a lot of inconsistency in information retrieval when different searchers select search terms to describe the same search request. Different search terms can, however, describe the same search concept. Thus it remains an interesting and still open question whether different searchers will select search concepts from the same search request inconsistently, or will they only describe the same search concepts with different search terms?

In our former study (Iivonen 1992) we were able to find that although different searchers selected search terms rather inconsistently, the same searcher selected the search terms from the same search requests on various occasions more consistently. However, there were also differences in selection of search terms by the same searcher on various occasions. Thus the necessary and so far unanswered question remains whether the same searcher will select search concepts from the same search request inconsistently, or will s/he only describe the same search concepts with different search terms?

In this article we compare consistency figures calculated on the basis of search terms and search concepts from the same query statements. Consistency means the degree of agreement in performing the same task (selection of search terms, selection of search concepts) on different occasions, and is considered here as intersearcher and intrasearcher consistency. We consider the effect of extending the scope of search concepts on the growth of consistency figures. The scope of search concepts is extended by controlling the semantic relationships between search terms.

2. Search term, search concept and query statement

A search term is defined as a string of characters, which is bounded by Boolean operators, or which starts or ends a query statement. It can be a descriptor or a free term or a code.

A search concept is defined as a subject of a search, as a unit of information taken into account in a query statement and described with one or more search terms. Search concepts...
correspond to an elementary class described with uniterms (e.g., "refugees") or a multi-criteria class described with adjectival phrases (e.g., "international problem") or compound words (e.g., "border trade").

A query statement (query, search formulation, search statement, search profile) is an expression of the search request in a form which is possible to be processed by an information retrieval system. It consists of search terms and operators used in combining search terms.

3. Data

The data for this study was collected in test situations where searchers with different backgrounds analyzed search requests and formulated query statements from them for a retrieval in a certain Finnish database KOTI. The searchers were allowed to use free terms and descriptors of the General Finnish Thesaurus as search terms. The only method of connecting search terms was Boolean operators. The data is described in greater detail elsewhere (Iivonen 1992). For this study we used only a part of data\(^1\) and compared query statements formulated by 12 searchers from eight search requests. Three searchers worked in special libraries, three in university libraries and three in public libraries, while three were students of library and information science. The search requests used in this part of data are presented in Table 1.

Table 1. The search requests\(^2\) used in the study

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<td>8.</td>
<td>National groups and ethnic conflicts in the Third World and their influence on the activities of international organizations</td>
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4. Methods

Intersucher consistency figures were calculated asymmetrically for each pair of searchers using the following formula:

\[
CT_{1,2} = \frac{|T_1 \cap T_2|}{|T_1|} = \frac{\text{number of search terms (concepts) in common}}{\text{total number of search terms (concepts) used by Searcher 1}}
\]

and

\[
CT_{2,1} = \frac{|T_1 \cap T_2|}{|T_2|} = \frac{\text{number of search terms (concepts) in common}}{\text{total number of search terms (concepts) used by Searcher 2}}
\]
The same formula was used in calculating the intrasearcher consistency. In that case, \( T_1 \) was the number of search terms/concepts the searcher used on the first occasion while \( T_2 \) was the number of search terms/concepts the same searcher used on the second occasion. \( |T_1 \cap T_2| \) was the number of search terms used by the same searcher on both occasions. This formula was selected for use because it has been used earlier by Fidel (1985) and Saracevic et al. (1987, 1988) and because we wanted to compare our results to the results of these studies.

The consistency figures were calculated at four different levels following the extending of the scope of search concepts (see Figure 1.).

At Level I consistency figures were calculated on the basis of search terms, and the search terms were compared character by character. Thus also different truncations of the same search term were considered as different search terms. Comparison of search terms character
by character was justified by the fact that the difference of one character affected search results in searching the KOTI database.

At Level II consistency figures were calculated on the basis of search concepts, and different search terms were accepted as the same search concept
- if they were descriptor or free term variations of the same search term
- if they were the singular or plural forms of the same search term
- if they were different truncations of the same search term
- if there was an equivalence relationship\(^3\) between the search terms. This level means still rather simple controlling of linguistic expressions.

At Level III different search terms were accepted as the same search concept, if they were different forms of the same search term (Level II), or if there was a hierarchical relationship between search terms. The third level entails, in addition to controlling of the forms of search terms, also controlling of the hierarchical approach of search request.

At Level IV, in addition to Level III, different search terms, between which there was a commonly recognized associative relationship\(^4\) or a coordinative relationship related to the search request, were also accepted as the same search concept. The fourth level already means a rather broad interpretation of the search concept.

If the same searcher used more than one search term to describe a search concept, and these search terms were combined with OR operator, the search terms were counted as one search concept. In these cases the searcher gave many names to one search concept. Instead of that, if the search terms were combined by AND or NOT operators, they were counted as separate search concepts. In these cases the searcher expressed that s/he was searching for the intersection of the search concepts (AND operator) or s/he wanted to cut something off from a certain search concept (NOT operator). Expressions representing multi-criteria classes and formed of free terms (e.g. “international” AND “problem”) were treated as search terms referring to one search concept, not as two search concepts connected by AND operator.

Because there were 12 searchers and eight search requests, and because consistency figures were calculated asymmetrically, there were 1,056 consistency figures\(^5\) for the intersearcher consistency at each level. Because the same 12 searchers formulated query statements on two separate occasions from eight search requests (one searcher only from six and one searcher only from five search requests) there were 182 consistency figures\(^6\) for the intrasearcher consistency at each level.

5. Limitations

There are a few limitations of the study. First, all search requests were from the area of social sciences. The results concerning some other subject area may be different but are not necessarily so. The different vocabulary of social sciences and sciences is well-known in the literature of information studies. Second, the data of this study was in Finnish. The results may have been affected by certain features of the Finnish language. In the Finnish language there are many compound words which are written as one, and this may affect consistency figures when they are calculated on the basis of search terms. In addition, in Finnish the cases of words are rendered by word-endings. Because of that truncation of search terms has to be considered carefully in information retrieval, and differences in truncation may lower consistency figures calculated on the basis of search terms considerably. In spite of these limitations, we believe that the results of this study are in any case able to show a direction.
6. Results

The intersearcher consistency calculated on the basis of search terms (Level I) remained rather low (mean value 29.9%). It was very near to consistency mean values achieved in the studies of Saracevic et al. (27%) and Fidel (26% in the case of "complex" search request). We can regard this as somewhat surprising because the studies of Saracevic et al. and Fidel were carried out in quite different research environments, and the search terms in their studies were in English while in this study they were in Finnish. However, the intersearcher consistency grew considerably with even rather simple evaluation of linguistic expressions. When different search terms between which there was an equivalence relationship, or different search terms which were different truncations, or singular and plural forms, or descriptors and free term variants of the same search term were accepted as the same search concept, the mean value of intersearcher consistency was already as high as 69.2%. The consistency figures grew about 10% with the controlling of the hierarchical approach, and again about 10% with the controlling of associative and coordinative relationships between search terms (see Figure 2.). Although there are differences in selection of search concepts between searchers, there are many more differences in selection of search terms.

![Figure 2. Mean values of intersearcher consistency figures calculated at different search term/concept levels](image)

The intrasearcher consistency calculated on the basis of search terms (Level I) was clearly higher (mean value 55.9%) than the intersearcher consistency (see Figure 3.). The searchers are more consistent in the selection of search terms when they are compared to themselves than what they are when they are compared to other searchers. Also, the intrasearcher consistency grew considerably with a simple evaluation of linguistic expressions, and it was very high even at Level II (mean value 82.4%). Again the effect of controlling hierarchical, associative and coordinative relationships was smaller. It is significant that intrasearcher consistency at Level IV was really very high (mean value 93.3%). The same searcher will in most cases select the same search concepts from the same search request. But s/he will also use different search terms to describe them. One searcher explained this as follows:

"It is just that yesterday it was raining and today the sun is shining. I do not want to be arrogant. I only mean that a man will behave differently on different days. Perhaps
In many cases it was difficult for the searchers even to see differences in search terms they selected on separate occasions. When the searchers after the test situations were asked to explain differences in query statements they had formulated on two separate occasions, they said that query statements were the same although there were differences in search terms but not in search concepts. This gives us reason to assume that searchers understand the search process related to the search concepts although they have to use search terms to describe them.

Although the intrasearcher consistency figures were higher than the corresponding intersearcher consistency figures, the effect of extending the scope of the search concept was quite similar in both cases. Even a rather simple evaluation of linguistic expressions increased consistency most. Searchers are not so inconsistent in selecting search concepts as they are in describing them.

7. Discussion

Inconsistency in information retrieval is a fact. This is understandable because searchers are human beings who are different and whose days are variable. Because we cannot deny inconsistency, we can try to understand it and profit from this understanding.

We know that there is also a lot of inconsistency inside present information retrieval systems and databases because authors and indexers have described the same topics with different words. It is obvious that different query statements will match with different representations of the same topic.

We found that already a rather simple evaluation of linguistic expressions affected most both the growth of intersearcher and intrasearcher consistency. This provides good opportunities for the designers of information retrieval systems, because those simple things are easiest to control in intermediary and information retrieval systems, and many developments in this direction have already been made (Vickery & Vickery 1993). Information retrieval systems can suggest the searcher consider such alternatives to search terms as singular or plural
forms, free text and descriptor variants, different truncations, different spellings, acronyms, proper names, synonyms, broader and narrower terms, even well-known related terms.

We can have two different viewpoints on inconsistency in information retrieval. On the one hand we can see consistency as an absolute value and emphasize consistency as a desired feature in information retrieval. This, however, seems to be impossible to reach and leads us to work with an everlasting unsolved problem. On the other hand we can consider consistency as a practice in information retrieval. In that case we have to admit the existence of inconsistency. This presents us with new challenges but also new possibilities in designing intermediary and information retrieval systems.

Notes

1. In the whole data there were 32 searchers and 12 search requests.

2. The search requests are translations from Finnish.


5. Query statements from 12 searchers were compared to 11 other searchers' query statements in respect to eight search requests. It makes $12 \cdot 11 \cdot 8 = 1056$ consistency figures.

6. The query statements from 12 searchers formulated on two separate occasions were compared. Ten searchers formulated two query statements from eight search requests, one only from six and one only from five. It makes $(2 \cdot 10 \cdot 8) + (2 \cdot 1 \cdot 6) + (2 \cdot 1 \cdot 5) = 182$ consistency figures.

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References


