user may be logically related to other information the user is not aware of. This means that, having read the information from a document D_1 before reading document D_2, the user can judge document D_1 as nonpertinent. Second, the level of presenting the subject as well as the material itself can cause certain difficulties in comprehension. For example, without knowledge of the probability theory, one cannot appreciate (and apply) a new probabilistic approach presented in a paper and would not be able to use it to solve one's problem. Third, the document may contain very little information useful for the reader and a considerable amount of information of no use to the reader. In this situation, although the user will use this small amount of information, he or she still can judge the document to be nonpertinent.

Clearly the situations described above can also cause difficulties in judging relevance. Besides, the list of similar situations can be expanded, for example, through situations described by Lancaster. However, these examples sufficiently show that the evaluation of pertinence is also not that precise. Because the user evaluates the pertinence according to the ideal IN and the expert judges relevance according to the expressed IN (and in both cases these evaluations are subjective), one can consider various interrelations between relevance and pertinence. For example, experts can judge a document relevant, while the user will regard it as nonpertinent. It is also conceivable that experts will judge a document as irrelevant, while the user marks it as pertinent. This phenomenon is quite familiar to investigators and was mentioned by a number of authors.

Pertinent documents are used for constructing query formulations as well as for correcting them based on the user's feedback. Relevant documents (as has been noted) are, as a rule, used in the evaluation (with the criteria defined by experts) of the quality of information retrieval itself. In essence, relevance is the basis for such popular IR system evaluation characteristics as recall and precision. Introduced in the mid-1950s, these characteristics are used in virtually all experiments conducted to evaluate the quality of retrieval in the system. The recall coefficient (the recall ratio) is defined as a ratio (often as a percent) of the number of relevant documents that are retrieved to the total number of relevant documents in the collection. The precision coefficient (precision ratio) is the (also often a percent) ratio of the number of retrieved relevant documents to the total number of retrieved documents. Analytically these coefficients can be written as follows:

$$R = \frac{n}{N}(\times 100\%) \qquad P = \frac{n}{M}(\times 100\%),$$

where

n = number of retrieved relevant documents;
N = number of relevant documents in the collection; and
M = number of documents retrieved.

In the following, when evaluating retrieval efficiency we will use these characteristics, namely recall and precision. When the user evaluates the results of the search (selected documents) it is necessary to modify the discussion by replacing the relevant documents with pertinent documents. However, this will not affect the computation of the evaluation characteristics.

5.8 Conclusion

In discussing the history of information retrieval, we showed that for thousands of years the process of search itself (more specifically, such operations as comparison and selection) was performed by humans, and natural language also served as the IRL. Because the participation of people in a search was always considered obligatory—and until the middle of the 20th century it was not even questioned—all the efforts toward creating and developing retrieval methods were oriented toward advancing the human search for information.

It should be pointed out that the development of retrieval methods traditionally proceeded in two directions. First, compression of the texts of documents allowed users to review the available collection much faster, and, second, compression of the collection itself served the same purpose. For thousands of years the work in this direction allowed people to avoid serious critical situations caused by the search for information. However, as Chapter 3 showed, the current information crisis exists because the traditional (manual) methods based on the ideas of compression are not able to cope with the existing flow of information. To overcome the existing crisis researchers, for the first time in history, took a close look at the human participation in a search process. Indeed, a person's speed in reviewing information is not only very low but is bounded by human physiology. As the result, a new, third direction, was developed whereby the human being does not participate in the search but is replaced by a computer. In other words, new direction was needed principally to develop search methods that were oriented toward a qualitatively new speed of reviewing (comparison and selection) documents in the collection. The absence of the human user during the search implied the impossibility of using natural language during the search. This was the reason for developing other IRLs that differed from natural languages. Such languages already exist and are called descriptor languages.

In describing these languages, this chapter not only examined different approaches to defining their lexical structures and the existing ideas of using different grammatical rules, but it also described different criteria of correspondence constructed on the basis of these languages. The analysis of these criteria revealed their strong and weak points and helped to explain the choice of these criteria in practice.