

	Pertinent	Nonpertinent
Retrieved	$r$	$l$
Nonretrieved	$b$	$d$
	$C = r + b$	$L = l + d$
		$N_0 = r + l + b + d$

Figure 10.1  
Conjugate table.

duced outputs and so on). The formal method also consists, in essence, of evaluating functional effectiveness on the basis of all required information, but this evaluation method follows certain formal rules. Note that certain data, like the number of pertinent documents in an output, are found by methods that are not at all formal. However, in the course of evaluating functional effectiveness, such data are given beforehand and for this reason the discussed method should be considered a formal one.

The exhaustive information for the evaluation of functional effectiveness is contained in the so-called conjugate table (Figure 10.1), which shows the state of the collection after the search and evaluation of the pertinence of its documents.

Researchers have found, however, that the conjugate table is not very convenient to use, either for the by-content evaluation of functional effectiveness or for the development of formal rules for such an evaluation. Therefore, search characteristics were suggested that are based on this table and are more convenient to use for the evaluation purposes. The most popular characteristics were the recall and precision levels of search mentioned earlier. The way in which these characteristics are described using the notation in the conjugate table is as follows:

$$R = \frac{r}{r + b} = \frac{r}{C} \quad \text{is the recall level,}$$

$$P = \frac{r}{r + l} = \frac{r}{N} \quad \text{is the precision level.}$$

One more search characteristic and a parameter describing the search collection, which are also often used, are noteworthy. We mean by this the characteristic known as the search specificity:

$$S = \frac{d}{l + d} = \frac{d}{L},$$

and the parameter known as the coefficient of commonality:

$$P_0 = \frac{r + b}{r + l + b + d} = \frac{C}{N_0}.$$

It is interesting to note that these search characteristics and parameter  $P_0$  are not independent of each other and their correspondence follows easily from the one described by Salton (1975). This ratio is written as follows:

$$P(1 - S)(1 - P_0) = R(1 - P)P_0.$$

Thus, in the evaluation of functional effectiveness, the search characteristics defined on the basis of the conjugate table are commonly used.

In the following discussion, we will mostly be concerned with the formal method of evaluation. First, note that outside of the development of content criteria for functional efficiency evaluation, there are practically no questions related to the purely by-content method (with a position to do an evaluation determined by content criteria, and having obtained the data required for the purpose, the evaluator generally acts as he or she sees fit). Second, the consideration of the formal method particularly meets the logic of our discussion; also, this is the only method enabling us to solve problems related to automation of the processes that are important for further progress in the field of document information retrieval (see Chapter 1). Therefore, development of the formal method of functional effectiveness evaluation has an important practical application.

The formal rules used for the discussed method are, naturally, based on search characteristics and usually the following is true:

1. Either, following the specified formal rules, a more complex search characteristic is made up from the search characteristics used in specifying these formal rules—such as  $R + P$ , which reflects the document search functional effectiveness as a whole and not some of its aspects, say, recall level (we will refer to such a characteristic as a *complex search characteristic* and often abbreviate it to CSC)—or such a CSC is specified as the initial one in the rules.
2. The rules under consideration include a formal criterion that enables one to evaluate the document search functional effectiveness on the basis of the obtained values of the respective CSC.

In Salton (1975), the complex search characteristics are also called single valued measures. We chose to call it a complex search characteristic based on the fact that these characteristics are intended for the evaluation of the complex search parameter. Clearly, use of the discussed formal method in informational practice requires that the CSCs within its framework allow pragmatically justified evaluation of the functional effectiveness; that is, that the obtained values of