

Two examples will illustrate the justification of the defined boundaries of domains of applicability of characteristics I_1 and I_2 . We will assume that two searches are conducted using the same search request on a collection of 10,000 documents of which 100 are pertinent, and two outputs are created as the result of the search, which we will designate A and B . The points of the ROP plane, which correspond to the achieved "recall-precision" pairs (for outputs A and B), we will refer to as the points under analysis in the given example, whereas the values of the complex search characteristic I_1 (I_2) for outputs A and B we will denote, respectively, as $I_1^A(I_2^A)$ and $I_1^B(I_2^B)$. The two examples are as follows:

1. Output A contains 75 pertinent documents and 5 nonpertinent documents; output B contains 95 pertinent and 34 nonpertinent documents. It is evident that the document search functional effectiveness in these cases can be considered as reasonably close and adequately high. At the same time, $I_1^A \approx 1.688$, $I_1^B \approx 1.686$, $I_2^A \approx 0.839$, and $I_2^B \approx 0.836$. It follows from this that, from the point of view of chosen CSC, the functional effectiveness for these two cases is close to each other and quite high. Thus, the points under analysis in this example have been justifiably included into the domain of applicability of complex search characteristics I_1 and I_2 .

2. Output A contains exactly 1 document, which is pertinent; output B contains 9 pertinent and 1 nonpertinent document. Evidently, the functional effectiveness of the document search resulting in output A should be considered low. The functional effectiveness of the search resulting in output B should be also considered as low, though this one is higher than that for the search resulting in output A . In these cases, $I_1^A = 1.01$ and $I_1^B = 0.99$. It is clear that the functional effectiveness should be considered acceptable and close in both cases in the sense of I_1 . Therefore, the points under analysis in the second example have been justifiably not included in the domain of applicability of the search characteristic I_1 . At the same time, $I_2^A = 0.1$ and $I_2^B \approx 0.284$. It follows then that the functional effectiveness of the search resulting in output A should be considered low in the I_2 sense, and that of the search resulting in output B also should be considered quite low though it is higher than that for the search resulting in output A . Therefore, the points under analysis in this second example are justifiably included in the domain of applicability of complex search characteristic I_2 .

It is evident that two examples are not sufficient for a full justification in defining boundaries of domains of applicability of characteristics I_1 and I_2 . However, it is unrealistic and beyond the scope of this book to consider all cases that would be adequate for such justification. Therefore, we have limited ourselves to the two examples that, in our opinion, provide a clear enough illustration of our approach to the justification for choosing boundaries of domains of applicability of these characteristics.

It follows from the analysis of the domains of applicability M_{I_1} and M_{I_2} that on attaining the recall and precision of the search that correspond to a point in the intersection of these domains (note that $M_{I_1} \subset M_{I_2}$) one can evaluate the

functional effectiveness with the help of either complex search characteristic I_1 or complex search characteristic I_2 . Such a situation makes possible a more flexible approach to an evaluation of functional effectiveness, although the choice of a specific CSC would need special justification.

Thus, we have considered the domains of applicability for two complex search characteristics, $I_1 = R + P$ and $I_2 = \sqrt{R \cdot P}$. These domains, in our opinion, also give an idea of possible boundaries for domains of applicability of other CSCs. It is clear as well that these domains define those limitations that take place in the application of the formal method of evaluation of functional effectiveness in cases when the method is based on complex search characteristic I_1 or complex search characteristic I_2 .

Determining the boundaries of domain of applicability for a specific CSC is equivalent to solving the following problem: For which recall and precision levels it is pragmatically justified to evaluate the functional effectiveness of a search using a given CSC? Of interest also is another problem, namely, to determine what values should be reached by the specific complex search characteristic to serve as the basis for a pragmatically justified evaluation of the functional effectiveness of a document search, that is, for application of the formal method to evaluate functional effectiveness. The set of all values of the complex search characteristic that may be used to pragmatically justify an evaluation of the functional effectiveness of a document search we will call the *set of basic values of CSC*. The problem thus formulated is no less complex than the one discussed earlier, and we have no algorithm to solve it either. However, with complex search characteristics that are functions of R and P , a knowledge of their domains of applicability can substantially simplify the solution to the formulated problem. This is clarified in the following discussion. If a certain line is specified by equation $F(R, P) = \alpha$ (where α is a constant)—with a part of the line inside the square bounded by lines $R = 0$, $R = 1$, $P = 0$, and $P = 1$ (Figure 10.2)—each point of that part will correspond to the same value of the complex search characteristic $F(R, P)$ (which is equal to α). We will refer to this part of the line as the line of equal values of the complex search characteristic $F(R, P)$ and denote it by $Z_\alpha(F(R, P))$. Figure 10.6 illustrates the lines of equal values of complex search characteristics I_1 and I_2 with $\alpha = 1.5$ for I_1 and $\alpha = \sqrt{0.5}$ for I_2 .

Clearly, if the equal values lines of the complex search characteristic $F(R, P)$, $Z_\alpha(F(R, P))$ is inside the domain of applicability for this characteristic, the constant α can be included into the set of basic values of this characteristic. Indeed, in the situation under discussion when the complex search characteristic $F(R, P)$ reaches a value equal to α , it can serve as the basis for pragmatically justified evaluation of the document search functional effectiveness. This conclusion follows from the fact that whatever the recall-precision pair produced in the search is, the point corresponding to this pair will be on the equal values line $Z_\alpha(F(R, P))$, which is within the domain of applicability of characteristic $F(R, P)$. In case the equal values line $Z_\alpha(F(R, P))$ is not totally inside the domain of applicability of the complex search characteristic $F(R, P)$,