1. BID (block of indexing of documents)—The indexing of documents can be affected by one of the following changes:
   (a) A change in the method of indexing
   (b) A change in the dictionary
   (c) A change in both the method of indexing and the dictionary
2. BIQ (block of indexing of search requests)—The process of constructing query formulations can be affected by the following changes:
   (a) A change in the method of constructing query formulations
   (b) The use of different information about the user's POIN
   (c) A combination of (a) and (b)
3. BSR (block of storage and retrieval)—It is possible to control the actual search (the comparison of query formulations with document profiles) by changing output criteria.
4. It is also possible to use a combined approach to make changes simultaneously in two or more elements.

It should be pointed out that scientific literature covers all of the mentioned approaches (see, e.g., Belew, 1989; Dillon, 1980; Frants & Shapiro, 1991b; Gordon, 1988; Rickman, 1972; Salton, Voorhees, & Fox, 1984; and Voiskunskii & Frants, 1974). However, not all of these approaches are equally acceptable (for example, some are more time consuming). Therefore, we will consider which of the elements of OC is the most expedient to control.

Given that in this book we are primarily considering IR systems with the Boolean criterion of selection, we will not control the BSR element of OC. Another element that will not be controlled is BID. The process of indexing all documents in the collection (especially in the case of a retrospective search) is an extremely time-consuming operation. Because feedback will have to react to each user individually, the change in the process of indexing documents will have to be performed for each user (and, moreover, for each request) during each iteration. Although this is possible to do in principle, it seems to us to be impractical. Even if there are only a few dozen users, it may be necessary to store hundreds of different versions of the same collection obtained as the result of different indexing. It seems clear that the element of the IR system that could be controlled most effectively is its BIQ. The choice of this element is the most natural for a majority of developers, and in functioning systems today only query formulations are corrected.

Hence, the system's operation is controlled by changing the query formulation. The purpose of this control is to affect the output of the system to better satisfy the user's POIN, and this is only possible on the basis of some information. But what can we say about information during the realization of adaptation in an IR system? First, it is necessary to clarify *what* information (which object) the system needs for correcting query formulations. Second, it is

important to know *who* will present this information and *how*. Third, there has to be a way of evaluating the result of control; that is, the system should be able to determine if its output is changing in the right direction. Any adaptation is performed on the basis of information characterizing the object to which one is adapting. This characterization is usually called a parameter. Hence, we first consider which parameter(s) is taken into consideration during adaptation.

We mentioned earlier that an IR system adapts to an actual user's POIN, and the goal of adaptation is satisfaction of POIN. All of the processes in the system (including adaptation) are created with this purpose. In the process of adaptation, the system should change into a state that satisfies POIN better than the old state. But what does "better" mean in connection with POIN? It means that the output of the system better corresponds to the thematical boundaries of POIN and that the output better corresponds to the user's level of perception. These conditions result in a decrease in the user's uncertainty. Hence, in providing information to the user, the system should try to take into account as precisely and fully as possible such characteristics of individual POIN as thematical boundaries and the level of perception. However, neither the first nor the second characteristic can be precisely discerned (and especially measured) because POIN does not have clear thematical boundaries and the level of perception, which depends on the existing patterns in the user's memory, can only be realized (and not always very clearly) by the user. Hence, the information necessary for adaptation could only come from the user.

This information from the user that the system utilizes for adaptation is often of low quality (see our discussion of the user's expression of POIN in Chapter 2) and, as a rule, does not provide any indication of the level of perception. In fact, the existing algorithms of adaptation do not actually consider the level of perception and only attempt to recognize the information related to the thematical boundaries of POIN (i.e., they try to adapt to these boundaries). It should be pointed out that the information about the POIN's boundaries has to be new, that is, information that was not available to the system before. If the system does not receive new (additional) information, then adaptation is not performed; this is because adaptation is only possible after the system has received new information. We say "additional" because the mechanism of adaptation is only activated after the initial search, that is, after the first output is formed. Clearly, to form the first output the system used some information about the user's POIN (for example, the search request), and any information characterizing POIN that was not entered into the system previously is considered additional information. This additional information should enter the system through the feedback line. Hence, in considering the mechanism of adaptation, we determined who provides necessary information, what this information describes, and the character of this information. But it is not yet clear in what form this information is presented to the system. We discuss this in some detail next.