ORGANIZATIONAL BEHAVIOR AND HUMAN DECISION PROCESSES 42, 217–233 (1988)

Limits to Decision-Making Ability in Direct Multiattribute Alternative Evaluation

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In recent years there has been considerable interest in how decision strategies in choice problems depend on such characteristics as the number of available criteria and the number of available alternatives. Along with multicriteria choice problems, classification tasks are treated where alternatives are classified into several decision (evaluative) classes. We believe that in classification problems one's ability in information processing is limited and depends on task complexity. In this paper we describe two experiments involving categorization of a large number of multiattribute alternatives into two or four evaluative classes. The results demonstrate that the subjects use different decision strategies and that there is a limit in human ability to implement these two tasks.

The multicriteria decision-making problem is widely employed in research. Practice-oriented problems may be divided into two groups: choice problems and classification problems. In choice problems a human being strives to order the alternatives or to choose the best one. In classification problems subjects refer the alternatives to several decision classes (ordinal or nominal).

The shared feature in these problems is that the alternatives are described through estimates upon a set of criteria. In practical activity human beings are often faced with problems where the alternatives are presented as a list of the object's characteristics rather than a real object whose conception depends considerably on the decision-maker's personality (e.g., the consumer's choice). In business decision-making the alternatives are often estimated by experts who employ a given set of criteria. The decision-maker expresses his (or her) policy through a list of criteria and a decision rule for evaluating different combinations of qualities (different combinations of criteria grades).

There is solid evidence beginning with Simon (1969) that people have difficulty with this kind of assessment task. It appears that when comparing objects on multiple criteria, people attempt to use simplifying de-

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0749-5978/88 $3.00

vices, the most common of which is the sequential consideration of criteria (Miller, Galanter, & Pribram, 1960; Simon, 1960; Slovic, Fischhoff, & Lichenstein, 1974; Tversky, 1969, 1972). That is, people screen alternatives for their adequacy (or discriminability) on a series of attributes. At each stage, they drop those that do not meet the requirements. In Simon's words (Simon, 1969), "Evidence is overwhelming that the system is basically serial in its operation: that it can process only a few symbols at a time and that symbols being processed must be held in special, limited memory structures whose content can be changed rapidly."

In the last decade there have appeared works (Klayman, 1983; Payne, 1976; Russo & Rosen, 1975) investigating how decision strategies in choice problems depended on such characteristics as the number of available criteria and the number of alternatives to compare. Different decision strategies used in choice problems were delineated, such as conjunction, elimination by aspects, various strategies of compensation, etc. An important outcome of these studies is, in our opinion, the realization that people change their decision strategies as task complexity grows. As it was shown in the experiments (Klayman, 1983; Payne, 1976; Russo & Rosen, 1975), with an increased load on human cognitive ability (increased number of criteria and alternatives), the subjects passed from compensatory models to sequential consideration of the criteria, to a priori elimination of a number of alternatives and to pair comparison of the alternatives left. In this way people reduce the load on their information processing system. However, not everybody behaves so. Others try to sustain some interest in all criteria. The greatest inconsistencies have been observed with subjects who undertake the latter strategy (Russo & Rosen, 1975; Tversky, 1969).

Along with multicriteria choice problems, people may come across classification problems when the alternative (or more exactly, its description in a multicriteria language) is referred to one of the decision evaluative classes (for example, evaluation of the quality of papers submitted to the conference committee, evaluation of the quality of products, etc.). Quite often these classes may be ordered by quality, i.e., the alternatives assigned to the first decision class are better than those assigned to the second class, etc. Despite the fact that such problems are quite common, human behavior in their solution has not been fairly investigated.

We assume (Larichev & Moshkovich, 1980) that in classification problems one's ability in information processing is also limited and depends on task complexity (the number of criteria, the number of estimates upon the criterion scale, the number of evaluative classes). One may assume that there exist rather simple tasks, solving which, one comes across few contradictions, employs complex compensatory strategies, and takes into account all the criteria. One may also assume that there are more complex tasks too where one's behavior pattern will change. Besides, one may suppose that there is some "border" between simple and complex tasks.

The present study looks at people's ability to sort decision options into general evaluative categories, such as "good" and "bad." An earlier study (Larichev, Zujev, & Gnedenko, 1979) showed that people were able to consistently sort into two evaluative categories options that were described on two levels on each of seven criteria. These subjects did not avoid inconsistencies, but used fairly complex (compensatory) strategies. On the other hand, evaluations were quite inconsistent when in another study, the number of evaluative categories increased to seven (Hoffman, Slovic, & Rorer, 1968).

This paper carries a description of experiments in categorization into two and four evaluative classes of a large number of multiattribute alternatives. In both cases the alternatives are estimated by five criteria, with each one having three gradations of the scale. Our hypotheses are that with a change of only one of the task characteristics (number of classes), the subjects will demonstrate different behavior and that the limit of one's capacity lies between these two tasks.

METHOD

Design

In each of two experiments, subjects sorted multidimensional alternatives into evaluative classes, on each of two separate occasions. On the one occasion, two evaluative classes were used; on the other occasion, there were four classes. Each alternative was characterized on five criteria, each with three levels of quality. Both the evaluative classes and levels of quality were ordered from best to worst. Therefore, as in many of our previous tasks (Zujev, Larichev, Filippov, & Chujev, 1979) the quality grades were described in verbal terms that may facilitate understanding.

Subjects

Two groups of subjects were selected. One consisted of experienced decision-makers, the other included individuals with no professional expertise in decision making.

Tasks

The educational task involved multicriterion evaluation of higher-education establishments according to their degree of attractiveness to students. The subjects were 16 ninth form graduates of a Moscow mathematical school, for whom this was a question of direct practical value.

The editorial task involved the evaluation for publication of manuscripts produced at a research institute. Customarily, manuscripts were sent for review to experts in the area; however, those reviewers often failed to consider aspects of the manuscript that the editorial board held to be important. As a result, the board wished to develop a standard evaluation form that would ensure attention to all topics. In our task, nine members of the actual editorial board evaluated various possible manuscript descriptions on these criteria. For organizational reasons, only four of these individuals were able to participate in the second session, using four evaluative categories.

Procedure

In the educational task, the pupils received options described on five criteria that we chose beforehand in discussion with them. They are described in Appendix A. In the editorial task, the five criteria were formulated in cooperation with the board members. They are described in Appendix B. Each criterion scale contained three grades expressed verbally. The evaluative classes that subjects considered appear in Appendix C and Appendix D. All possible combinations of criteria estimates (3E5 = 243 alternatives) were divided over three questionnaire lists. Subjects responded by giving each alternative the number of the evaluative class that seemed appropriate to them. Each subject evaluated all 243 alternatives.

In the educational task, subjects were divided into two groups of 8. One used the two evaluative classes the first time and the four classes the second time. For the second, the order of the tasks was reversed. In the editorial task, all subjects used two classes the first time and four the second and also evaluated all 243 alternatives.

Data Analysis

Four measures of performance were used:

(a) *Number of inconsistencies.* After all alternatives were assigned to categories, each was compared with all other alternatives. An inconsistency was recorded each time that an alternative was assigned to a lower category than other alternatives that it dominated. An alternative was considered to dominate another alternative if it was at least as attractive on each of the five criteria (since no two alternatives were identical, this means that it was superior in at least one respect). For instance, let us assume that we have criteria A,B,C,D,E. The A_1 mark implies the first (best) gradation upon the A criterion scale. Similarly B_2 signifies the second gradation upon the B criterion scale, etc. Then a certain combination of estimates upon the set of criteria may be presented as $A_1B_2C_3D_1E_2$. Let us suppose that the subject categorized this alternative to the second evaluative class (for a case of four possible evaluative classes). The gradations upon the criteria scales are ordered from the best to the worst, and evaluative classes are also ordered from the most to the least preferable ones. Therefore, according to the rule of dominance all the alternatives that are estimated not lower than the given one, should belong to as high a class as the given alternative. For example, the alternative $A_1,B_2C_1D_1E_2$ should not be categorized to the third or fourth evaluative class. Thus, if the subject categorizes this alternative to the third class, we believe that there is a contradiction between his (her) two answers (in this case it is not clear to what class it should really belong).

With this method, a single erroneous categorization can result in a large number of inconsistencies. As a result, we developed an algorithm that calculated the minimal number of changes in categorization that would suffice to eliminate all inconsistencies (Moshkovich, 1982).[1]

(b) *Evaluation strategy.* We identified a set of rules that a subject might have used in assigning options to categories. These strategies can be viewed as defining the boundary line between evaluation classes. They were identified after we had applied the algorithm necessary to eliminate all inconsistencies.

Let us explain the meaning of a border between two classes and how one can determine it. Let it be assumed that there are two evaluative classes. After the subject's noncontradictory estimates of all the alternatives, the entire set (of alternatives) is broken down into two groups: the first class and the second class. In the first class one can determine the alternatives that do not dominate any other alternatives from this class. The totality of these alternatives is characterized by the fact that all the alternatives dominating these belong to the first class, and those dominated by them to the second. In this sense this totality of alternatives is called a border between the two classes. In the case of four classes the borders between the first and the second class, the second and the third, and the third and the fourth class, respectively, are defined in a similar way. Let us assume for our example that the border between the first and the second class consists of the following three elements: $A_1B_1C_1D_2E_2$, $A_2B_1C_1D_1E_1$, $A_1B_3C_2D_2E_1$. It means that all the alternatives dominating them belong to the first class, and those dominated by them to the second one.

In considering such responses, it is useful to distinguish between two sources of inconsistency. One is accidental misclassifications, as reflected in cases in which a single reclassification greatly reduces the num-

[1] The description of the algorithm used is not presented here as it is a special mathematical problem.

ber of inconsistencies. The other is inherent inconsistencies, reflected in the stable features of subjects' preferences. With such cases, reclassification does little to improve the consistency of the set. We defined the distance of an alternative from the boundary line by the number of alternatives dominating it being categorized to more preferential classes.

Let us consider the above example. If the subject categorized the alternative $A_1B_2C_2D_2E_1$ to the second class, that estimation was contradictory to only one alternative—$A_1B_3C_2D_2E_1$. If the subject categorized the alternative $A_1B_2C_1D_1E_1$ to the second evaluative class, then that estimation was contradictory to the evaluation of the alternatives $A_1B_2C_1D_2E_1$, $A_1B_2C_2D_1E_1$, $A_1B_2C_2D_2E_1$, $A_1B_3C_1D_1E_1$, $A_1B_3C_1D_2E_1$, $A_1B_3C_2D_1E_1$, and $A_1B_3C_2D_2E_1$, which had been categorized to the first class.

(c) *Solubility.* We characterized the performance of individual subjects as having failed to solve the problem if (a) at least one boundary element was obtained as a result of changing a classification and (b) if more than two changes were needed in the elements for which their distance from the boundary line was equal to 1. Thus, subjects managed the task only if they made no more than two errors within the boundary area.

(d) *Complexity.* In general, the number of boundary elements can be taken as an indication of the complexity of a subject's strategy. One easy way to obtain a consistent, "successful" ordering is to look at only a single criterion. A simplistic way to look at several criteria is to use conjunctive rules, which require bearing in mind only a cut-off value on each criterion. Conjunctive rules are represented in the boundary lines by alternatives in which all attributes, other than the cut-off one, are superior. More complex strategies result in boundary elements that are different from the initial ones. These can be considered as compensatory rules.

Thus, the number of boundary elements and their form can serve well for describing the complexity of the strategy employed by the subject for classified alternatives.

Images. Finally, we note that there are complex, configurative rules that people may use in certain circumstances (Klatsky, 1979; Larichev, 1979; Miller, 1956). These rules comprise personally meaningful images for specific combinations of criteria scores, such as "the article does not concern the major theme of institute activity, hence it should be published only if it has unusual theoretical or practical importance" or "difficult exams are worth taking if you like the profession and the competition is not great." Although such rules seem complicated in terms of the number of criteria mentioned in them, they are readily easy to memorize and utilize. The set of rules that a subject uses can be considered as analogous to a structural unit of information (Klatsky, 1979; Slovic, 1969). Simon (1960) has found these units to vary in size. We attempted to identify them in the present context as follows: The common parts of boundary elements were grouped together. Those combinations that were used frequently were considered to be images. Grouping of alternatives that differed from the favored alternative in the same number of attributes allowed us to determine how frequently subjects relied on specific images.

RESULTS

Education Experiment

Table 1 presents the number of inconsistencies, the number of changes needed to produce a consistent order, the number of boundary elements, and the data describing the properties of the boundary elements. In this case of assigning alternatives to one of two categories, the number of inconsistencies varied widely (from 4 to 83), as did the number of changes required. Nonetheless, according to our criterion, only two subjects (3 and 6) failed to solve the problem. Given the large number of elements in the boundary for most subjects, an additional logical analysis was added. It resulted in Table 2's summary of the subrules used by subjects. In no case did any subject use more than five subrules, as one might expect on the basis of short-term memory's ability to handle no more than 5–7 units. We believe that the number of structural units, as shown here, is the best indicator of the complexity of subjects' strategies.

Analogous data were also calculated and analyzed for the second subgroup of subjects, dealing with four evaluative classes in the first interview and also for both subgroups for the second interview (in this interview the first subgroup dealt with four classes and the second with two evaluative classes).

Generalized data is presented in Table 3.

Clearly, subjects of the second subgroup in the first interview, had many more inconsistencies than the subjects using only two categories. Similarly, the class boundaries involved a larger number of complex elements. Indeed, the boundaries are determined more by changes than by subjects' answers. The analysis of changes showed that no subject solved the problem with four categories. The large number of boundary elements indicates that subjects did their best to use complex strategies, but were frustrated by the heavy burden of the task.

This contrast between the relative difficulty of the two tasks was substantiated in the second interview. Again subjects managed to assign the alternatives to two categories but not to four. The average values, listed in Table 3, indicate that subjects succeeded in assigning the multiattribute alternatives to one of two decision classes. The average number of inconsistencies (39.1) and average minimal number of changes (8.9) is 2.5 and 3.2 times less, respectively, for this problem than for one with four

TABLE 1
NUMBER OF CONTRADICTIONS, MINIMAL NUMBER OF CHANGES REQUIRED TO BRING SUBJECTS' ANSWERS TO A CONSISTENT FORM, AND PROPERTIES OF BOUNDING ELEMENTS (FIRST EXPERIMENT, FIRST INTERVIEW)

Subject number	Total number of contradictions	Minimal number of changes	Number of boundary elements	Number of boundary elements with assessments differing from the first one				
				on one criterion	on two criteria	on three criteria	on four criteria	on five criteria
1.	39	6	12	2	4	5	—	1
2.	40	8	13	2	5	5	1	—
3.	54	14	8	2	2	4	—	—
4.	20	8	6	2	4	—	—	—
5.	44	5	5	1	4	—	—	—
6.	83	19	13	—	6	3	2	2
7.	29	9	10	2	5	3	—	—
8.	4	2	14	3	3	7	1	—

TABLE 2

ANALYSIS OF STRUCTURAL UNITS IN SUBJECTS STRATEGIES (FIRST EXPERIMENT, FIRST INTERVIEW)

Subject number	Number of subrules (structural units)	Number of subrules consisting of: one element	two elements	three elements	four elements	five elements	six elements
1.	4	—	2	1	1	—	—
2.	5	—	4	—	1	—	—
3.	5	—	2	2	1	—	—
4.	2	—	1	1	—	—	—
5.	2	—	1	1	—	—	—
6.	5	—	2	—	3	—	—
7.	4	—	2	2	—	—	—
8.	5	—	2	2	1	—	—

TABLE 3

COMPARISON OF NUMBER OF CONTRADICTIONS, CHANGES, BOUNDARY ELEMENTS AND SUBRULES IN SUBJECTS STRATEGIES BETWEEN INTERVIEWS ACCORDING TO ORDERING OF EXPERIMENTAL TASKS

		First interview				Second interview			
	Subject number	Number of contradictions	Minimal number of changes	Number of boundary elements	Number of subrules	Number of contradictions	Minimal number of changes	Number of boundary elements	Number of subrules
1st subgroup	1	39	6	12	4	60	22	24	10
(first-two classes,	2	40	8	13	5	84	18	14	8
then four classes)	3	54	14	8	5	45	12	22	11
	4	20	8	6	2	134	38	24	10
	5	44	5	5	2	95	15	8	5
	6	83	19	13	5	131	26	11	7
	7	29	9	10	4	132	34	25	12
	8	4	2	14	5	107	29	35	14
		$\bar{x}$ = 39.1	$\bar{x}$ = 8.9	$\bar{x}$ = 10.1	$\bar{x}$ = 4.0	$\bar{x}$ = 98.5	$\bar{x}$ = 24.3	$\bar{x}$ = 20.4	$\bar{x}$ = 9.6
2nd subgroup	9	77	19	29	12	9	3	17	6
(first-four classes,	10	68	28	20	11	41	12	12	6
then two classes)	11	104	32	22	11	66	13	5	3
	12	118	30	24	12	7	2	7	4
	13	110	40	8	4	0	0	4	2
	14	68	20	17	8	102	10	3	2
	15	97	27	15	10	85	9	9	3
	16	137	29	12	7	32	9	5	4
		$\bar{x}$ = 97.4	$\bar{x}$ = 28.1	$\bar{x}$ = 18.4	$\bar{x}$ = 9.4	$\bar{x}$ = 42.8	$\bar{x}$ = 7.3	$\bar{x}$ = 7.9	$\bar{x}$ = 3.8

decision classes (where the average number of inconsistencies is 97.4 and average changes is 28.1). This corresponds to the generally acknowledged fact that the four-class problem is more complicated than the two-class problem. If we compare the average number of boundary elements and subrules, we can see that similarly these indicators are also 1.8 and 2.4 times less, respectively, than those for the problem with four classes. In all these respects, the four category evaluation task was beyond subjects' information-processing ability.

Two way analyses of variance were made to test our expectations that *number of classes* and *order of representation* (first-two classes, then four classes vs first-four classes, then two classes) might have a significant effect on the dependent variables investigated in the experiment.

The analyses showed that *number of classes* (2 vs 4) has a significant effect on all four variables investigated (number of contradictions, number of changes, number of boundary elements, and number of subrules).

However, *order of representation* was found to have no significant effect on any of the variables we investigated, and there were no significant interactions.

A possible objection to the use of ANOVA techniques here is that there is no basis to assume that our data were normally distributed. Because of this, we also used the ranking test suggested by Benard and Elteren (1953) on our data.

Results showed that according to this analysis also, the variable *number of classes* had a significant effect on all the dependent variables, while *order of representation* again was shown to have a nonsignificant effect on all of them.

Editorial Experiment Results

Table 4 presents summary statistics from the first session. It shows that, despite considerable variability, all subjects managed to solve this problem. The analysis showed that the number of boundary elements varied from 3 to 10. Subjects sometimes employed rather complex elements in their evaluation strategies, reflected in the boundaries with large numbers of complex elements. After structuring boundary elements we

TABLE 4
NUMBER OF CONTRADICTIONS AND MINIMAL NUMBER OF CHANGES REQUIRED TO BRING SUBJECTS' ANSWERS TO A CONSISTENT FORM (FIRST EXPERIMENT)

Subjects	1	2	3	4	5	6	7	8	9
Number of contradictions	0	4	9	19	21	41	16	38	35
Minimal number of changes	0	1	2	5	6	12	5	10	5

found that most subjects used two to three structural units consisting of two to three elements each.

Subjects 1, 3, 5, and 9 participated in the second session, which involved referring alternatives to four categories. Their responses are summarized in Tables 5 and 6. A surprising result here is the reduction in the number of inconsistencies and changes in this occasion, with a seemingly more difficult task. Although this was a within-subjects design, the large time gap between the two sessions precluded any attribution to learning. Some clarification comes from the analysis of subjects' strategies in Table 6. These were significantly simpler here than in the first session.

DISCUSSION

We believe that when studying how people evaluate multiattribute alternatives, it is important to determine what strategies they use. In doing so, level of complexity is an important criterion, one that is determined by the limits of short-term memory.

In real-life applications decision makers attempt to employ complex strategies, in keeping with the belief that all mentioned criterion should be reflected in their decisions. Unfortunately, this effort to attend to all possible nuances in the utility of alternatives, rather than just consider a combination of cutoff criteria, runs into limits imposed by human information-processing abilities.

Our first task involved pupils, for whom the decision was important, but who had none of the skills of experienced decision makers (e.g., identifying key factors, noting omissions, clearly specifying objectives). They were able to use two evaluative classes, but not four. These limits are consistent with those noted by Miller (1956) and others. Indeed, in no case did any subject use strategies involving more than nine subrules.

The editorial task was probably equally important for the subjects who considered it. However, they bore the added responsibility of being judged by their peers and needing a defensible rationale for their decisions. When the task became more difficult (with the expansion to four evaluative categories), they could not allow themselves to appear inconsistent. Instead, they resorted to simplified strategies. Despite the rather small sample here (especially in the second session), it is our observation

TABLE 5
NUMBER OF CONTRADICTIONS AND MINIMAL NUMBER OF CHANGES TO BRING SUBJECTS' ANSWERS TO A CONSISTENT FORM (SECOND EXPERIMENT)

Subjects	1	3	5	9
Number of contradictions	6	12	12	18
Minimal number of changes	1	2	1	1

TABLE 6
PROPERTIES OF BOUNDARY ELEMENTS (SECOND EXPERIMENT)

Subjects	Boundary between classes	Number of boundary elements	Number of boundary elements differing from first one				
			one criterion	two criteria	three criteria	four criteria	five criteria
1	4–3	1	1	—	—	—	—
	3–2	1	1	—	—	—	—
	2–1	2	2	—	—	—	—
3	4–3	5	1	—	2	2	—
	3–2	1	1	—	—	—	—
	2–1	2	1	1	—	—	—
5	4–3	1	1	—	—	—	—
	3–2	1	1	—	—	—	—
	2–1	4	2	2	—	—	—
9	4–3	2	2	—	—	—	—
	3–2	2	1	1	—	—	—
	2–1	1	1	—	—	—	—

in applied work with decision makers that such simplification-for-the-sake-of-consistency is quite a common strategy. It allows decision makers to succeed, in the sense of our criterion. However, the result seems to be the use of strategies that utilize but a small part of the available evidence. These results are in keeping with previous research (Hogarth, 1974; Schwartz, Vertinsky, Ziemoa, & Bernstein, 1975; Slovic, Fischhoff, & Lichtenstein, 1977).

Proceeding from the published data (Hoffman *et al.,* 1968; Klayman, 1983; Larichev, Boichenko, Moshkovich, & Sheptalova, 1980; Larichev & Moshkovich, 1980; Payne, 1976; Russo & Rosen, 1975; Slovic, 1969) and from our observations of people's behavior in various tasks of multicriteria classification we may put forward a hypothesis that one's capacity in these tasks can be roughly characterized by Table 7 where the squares contain the number of criteria which enable the majority of subjects to manage the task.

This table shows the maximum number of criteria with which people can consistently use complex strategies. When real-life applications demand more complex evaluations, we would recommend using simpler rules or relying on direct evaluation of alternatives over restricted domains of the option set (Larichev *et al.,* 1979).

APPENDIX A

List of Criteria in Experiment 1

Criterion A: Competition

1. Competition is small: 1.5–3 persons per place.

TABLE 7
NUMBER OF CRITERIA WHICH MAY BE RELIABLY CLASSIFIED, ACCORDING TO NUMBER OF CLASSES OF DECISIONS AVAILABLE FOR USE IN THE CLASSIFICATION TASK

		Number of decision classes into which alternatives may be classified consistently			
		2	3	4	>4
Number of categories on the ordinal attribute scale used to assess the alternatives	2	7 to 8	6 to 7	5	2 to 3
	3	5	2	3	2
	>3	2 to 3	—	—	—

2. Competition is medium: 4–5 persons per place.
3. Competition is big: 8–10 persons per place.

Criterion B: Complexity of Entrance Exams

1. Exams are not difficult at the level of school finals.
2. Exams are more difficult than the finals, but it is possible to get ready for them.
3. Exams are difficult, problems are unique just like at olympiads.

Criterion C: HEE Prestige

1. The HEE is considered one of the best in the country.
2. The HEE ranks among the high level institutes.
3. The HEE is considered to be on a rather medium level.

Criterion D: Attractiveness of Profession Provided by the HEE

1. You like very much the profession provided by the HEE.
2. The profession provided by the HEE is not very much to your liking but it can be acceptable for you.
3. You do not like the profession provided by the HEE.

Criterion E: Conformity of Profession Provided by the HEE to Your Personal Traits and Capabilities

1. The profession provided by the HEE quite suits your personal traits, capabilities, inclinations, etc.
2. The profession provided by the HEE does not fully suit you though corresponding to your capabilities and inclinations, though, generally speaking, it is acceptable for you.
3. The profession provided by the HEE in no way corresponds to your personal traits, capabilities, and inclinations.

APPENDIX B

List of Criteria Used in Experiment 2

Criterion A: Novelty of the Proposed Material

1. The basic results of the work are published for the first time.
2. The majority of the results are new.
3. Generalization of previously published results.

Criterion B: Practical Verification of Results

1. The mentioned results are verified on practical problems.
2. Practical verification of results is to be carried out.
3. Practical verification of results is not supposed to hold.

Criterion C: Conformity to the Basic Lines of the Institute's Activities

1. The work directly relates to the basic lines of the Institute's activities.
2. The work relates to the fields supporting the development of the basic lines of the Institute's activities.
3. The work does not conform to the basic lines of activities.

Criterion D: Presence of Errors

1. There are no errors.
2. There are insignificant errors.
3. There are errors to be removed.

Criterion C: Readability

1. The material is intended for a wide audience.
2. The material is intended for specialists in this field.
3. The material is intended for a narrow range of specialists in this field.

APPENDIX C

Decision Classes Used in Experiment 1

The Set of Two Final Decision Classes

1. The given HEE is acceptable for you to enter.
2. The given HEE is unacceptable for you to enter.

The Set of Four Final Decision Classes

1. The given HEE suits you very much for entering.
2. The given HEE is acceptable for you to enter, but with one condition: the exams are held 1 month prior to exams at other HEEs.

3. The given HEE is acceptable for you to enter only in case you had understood that you will be unable to enter other HEEs suitable for you.

4. The given HEE is not acceptable for you to enter.

APPENDIX D

Decision Classes Used in Experiment 2

The Set of Two Final Decision Classes

1. The work deserves to be included in the Institute's publication plan.

2. The work needs additional reviewing and consideration.

The Set of Four Final Decision Classes

1. The work undoubtedly deserves to be included in the Institute's plan of publications.

2. The work deserves to be published, but not for a wide circulation.

3. The work needs additional reviewing and corrections.

4. The work must be rejected.

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RECEIVED: June 25, 1986