Figure 19 shows the relation between Y and Aptitude at selected Difficulties as well as the relation between Y and Difficulties at selected Aptitudes. These sketches are the same as Figures 4 and 5.

Table 12 contains selected values generated from Model 2 with the parameter specified above. This output is the same as Table 1. Figure 20 is a three-dimensional representation of the model. It is identical to Figure 6.

Model 3

A third general model that follows easily from Model 2 is essentially the same as Model 2, but allows control of inflection points rather than slopes = 0. The development of Generalized Model 3 is described in Appendix G.

Model 3 is expressed exactly as Model 2, except with the following differences for B(3), B(4), and B(6).

B(3) = ((DEXP/2) * (Y(KONA, KONDCH) - Y(KONA, KOND)))/((D(KONDCH) - D(KOND)) ** (DEXP - 1))

B(4) = (Y(KONACH, KONDCH) - Y(KONACH, KOND) + (((DEXP - 2)/2) * (Y(KONA, KONDCH) - Y(KONA, KOND))))/(((A(KONACH) - A(KONA)) ** AEXP) * ((D(KONDCH) - D(KOND)) ** DEXP)

B(6) = ((-B(3)) * (DEXP - 2))/(DEXP * (D(KONDCH) - D(KOND)))

This model has the same properties as Model 2 except that instead of controlling D-slope = 0 this model moves the inflection point of D-slope from A(KONA), D(KONDCH) to A(KONACH), D(KOND). This allows for a slightly different expression of policy.

Figure 21 shows sketches of Model 3. Comparison of Figure 21 with Figure 18 will contrast Models 2 and 3.

The general form of Model 3 will be used for Example 1 with the same parameter settings as used to specify Model 2. This provides an easy comparison between Models 2 and 3. The output of Model 3 is shown in Table 13. Figure 22 is a three-dimensional representation of Model 3, and it can be compared with Figure 20.

Combining the Models

The three models have been combined into an interactive FORTRAN computer program for ease of use. Model 2 and 3 were combined, as described in Appendix H, prior to computer implementation. Appendix I contains the computer program along with an example of its execution.

As an aid to specifying policies, sketches of Models 1, 2, and 3 for all combinations of KONA and KOND can be placed together as shown in Figure 23. a policy maker might be able to better express his policy by selecting a sketch from among the available possibilities. This approach was used during discussions of simulations of the choices made by applicants who are presented an ordered list of jobs.

The goal was to create a model to express "tendency to choose a job," Y, as a function of Rank Order on the list, and a Preference Rating for the job. The Rank Order is to be associated with variable A and the Preference Rating is associated with D. Rank Order ranges from 1 (high) to 15 (low) and Preference Ranges from 9 (high) to 1 (low).

1. The highest value, Y = 100, occurs at Rank = 1 (high) and Preference Rating = 9 (high); i.e., at A(1), D(2). This translates to parameter settings

Y(1,2) = 100 (Y value at A(1), D(2))

2. The lowest value, Y = 1 occurs at Rank = 15 (low) and Preference Rating = 1 (low); i.e., at A(2), D(1). This translates into

Y(2,1) = 1

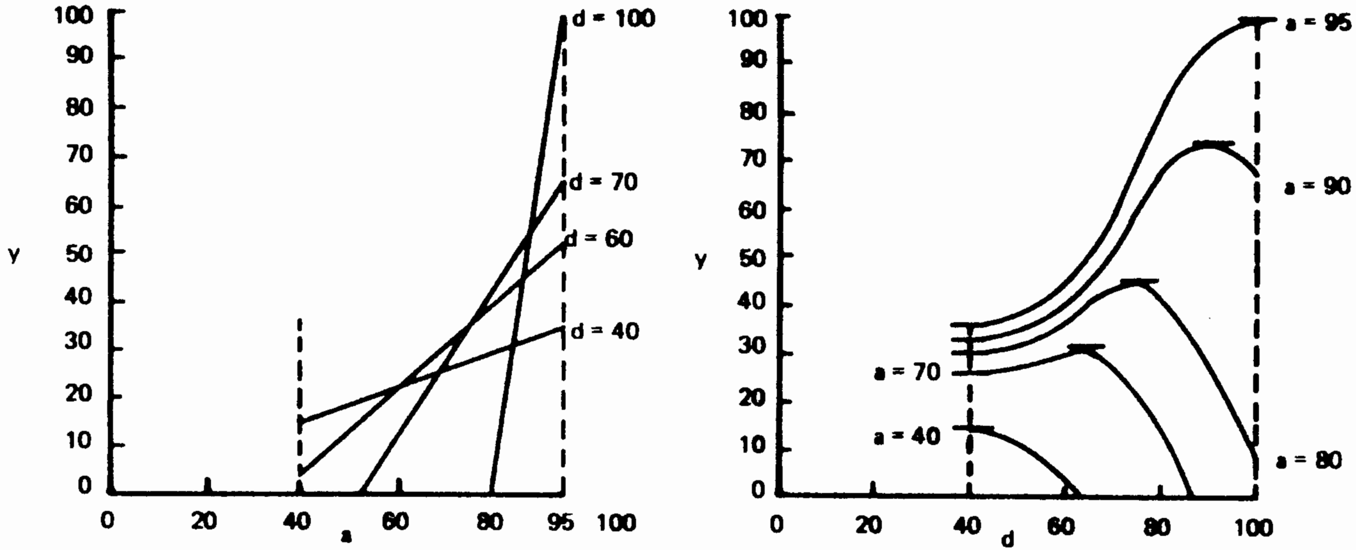


Figure 19. **Y (payoff) = function of a at d = 40, d = 60, d = 70, d = 100.**
Y (payoff) = function of d at a = 40, a = 70, a = 80, a = 90, a = 95.

Table 12. Y (Payoff) = Function of a (aptitude) and Third Degree Function of d (difficulty) Using Model 2

```
MODEL=2

Y(1,1)=   15 Y(2,1)=   35 Y(1,2)=-250 Y(2,2)= 100
AEXP= 1 DEXP= 3 KONA= 2 KOND= 1
A(1)= 40 A(2)= 95 D(1)= 40 D(2)=100
KSTARA= 95 KSTOPA= 40 KINCA= -5
KSTARD= 40 KSTOPD=100 KINCD=  5


Y =    35 + [< .3636+00>*(A -   95)** 1] + [< .5417-01>*(D -   40)** 2]
          + [< .1136-04>*[(A -   95)** 1]*[(D -   40)** 3]]
          + [< .9848-03>*[(A -   95)** 1]*[(D -   40)** 2]]
          + [<-.6019-03>*(D -   40)** 3]
```

D I F

		40	45	50	55	60	65	70	75	80	85	90	95	100
	95	35	36	40	45	52	59	67	76	83	90	95	99	100
	90	33	34	37	42	48	54	60	65	70	73	74	73	68
	85	31	32	35	39	43	48	52	55	56	56	53	46	36
	80	30	30	33	36	39	42	44	45	43	39	31	20	5
	75	28	28	30	33	35	36	36	34	30	22	10	-6	-27
A	70	26	27	28	30	31	31	29	24	16	5	-11	-32	-59
P	65	24	25	26	26	26	25	21	14	3	-12	-32	-58	-91
T	60	22	23	23	23	22	19	13	4	-10	-29	-53	-84	-123
	55	20	21	21	20	18	13	5	-7	-24	-46	-75	-111	-155
	50	19	19	19	17	14	7	-3	-17	-37	-63	-96	-137	-186
	45	17	17	16	14	9	2	-10	-27	-50	-80	-117	-163	-218
	40	15	15	14	11	5	-4	-18	-38	-64	-97	-138	-189	-250

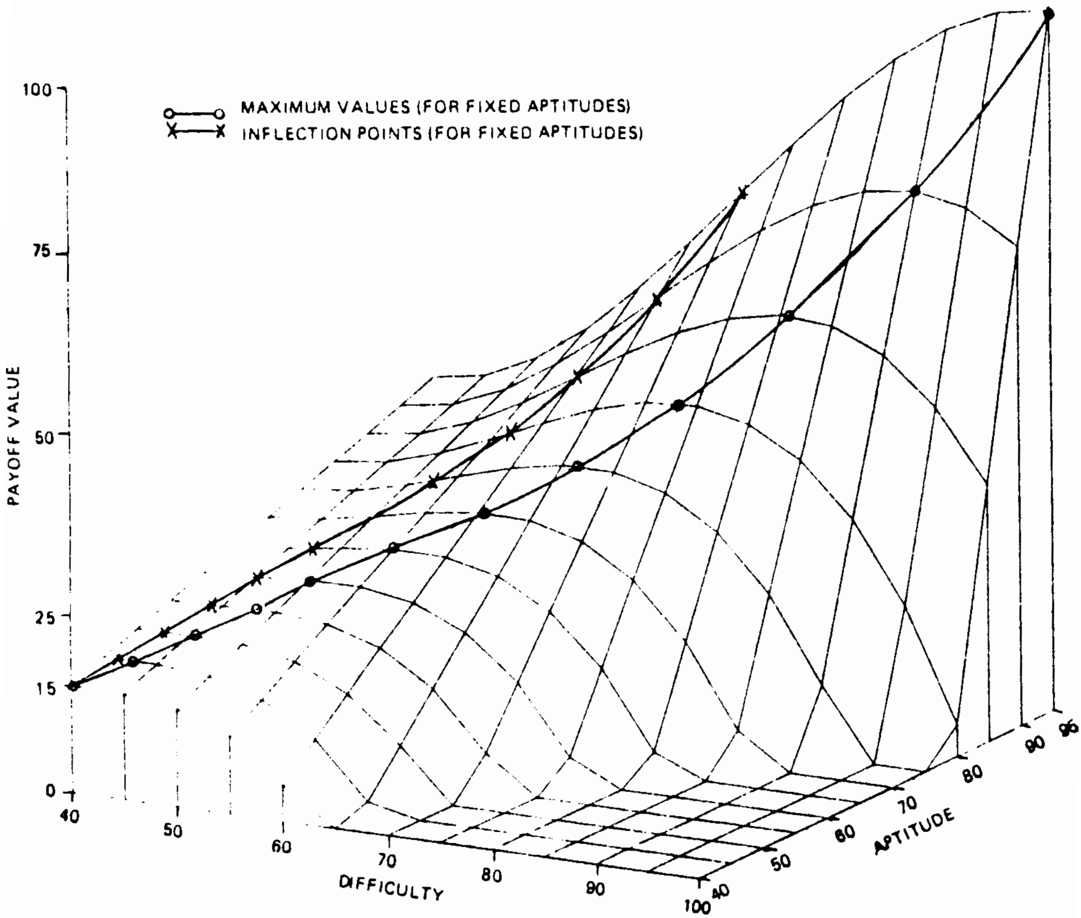
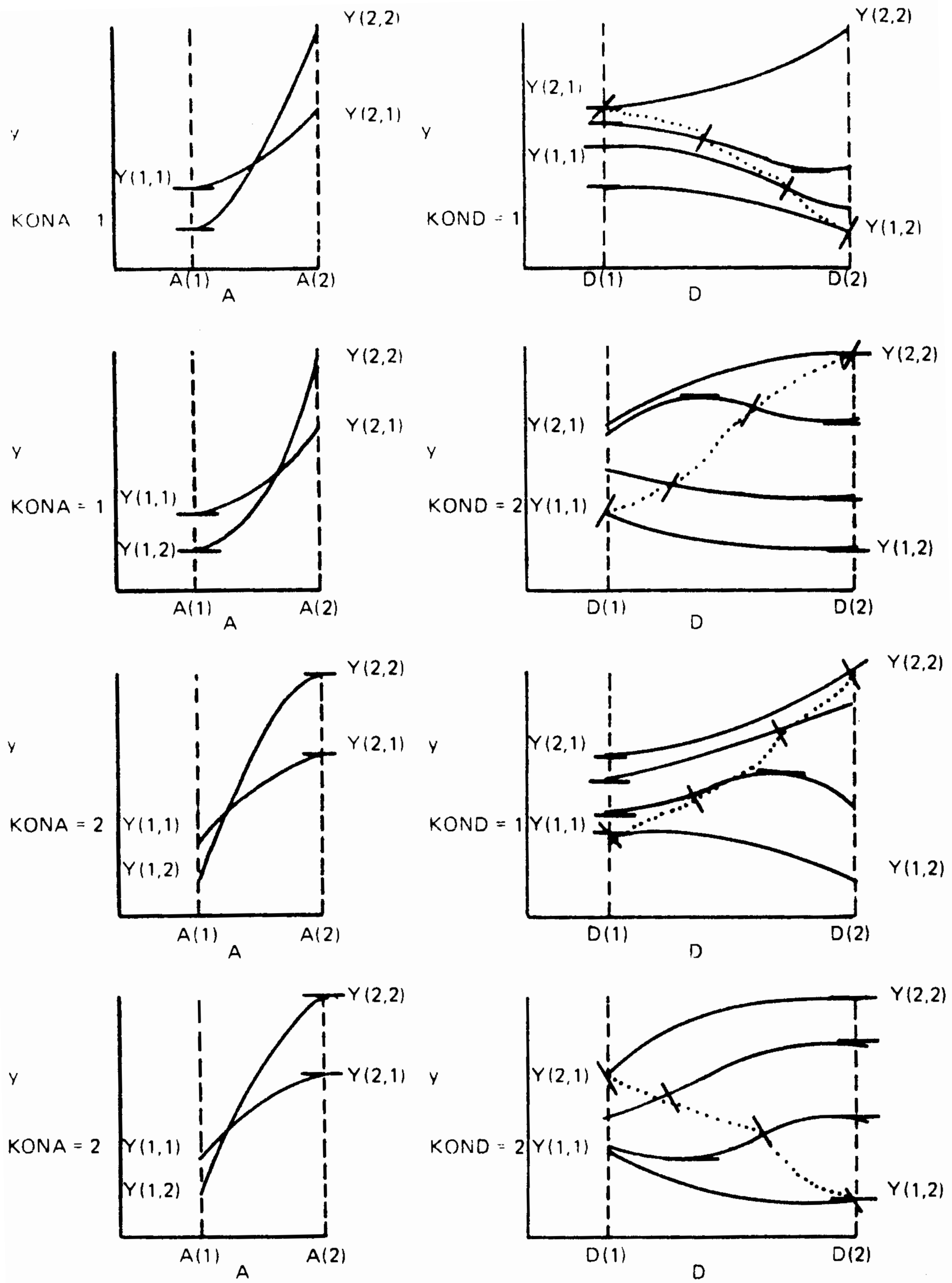


Figure 20. **Three-dimensional view of Model 2. Aptitude-Difficulty Component.**



Note: Horizontal Dark lines (——) indicate slope = 0
Slanting Dark Lines (/) indicate inflection points.
Dotted Lines (. . . .) indicate connected inflection points.

Figure 21. **Y (payoff) = function of A and D. Examples of parameter settings for Model 3.**

Table 13. **Y (Payoff) = Function of a (aptitude) and Third Degree Function of d (difficulty) Using Model 3.**

```
MODEL=3

Y(1,1)=   15 Y(2,1)=   35 Y(1,2)=-250 Y(2,2)= 100
AEXP= 1 DEXP= 3 KONA= 2 KOND= 1
A(1)= 40 A(2)= 95 D(1)= 40 D(2)=100
KSTARA= 95 KSTOPA= 40 KINCA= -5
KSTARD= 40 KSTOPD=100 KINCD=  5


Y =    35 + [< .3636+00>*(A -   95)** 1] + [< .2708-01>*(D -   40)** 2]
          + [< .1957-04>*[(A -   95)** 1]*[(D -   40)** 3]]
          + [< .4924-03>*[(A -   95)** 1]*[(D -   40)** 2]]
          + [<-.1505-03>*(D -   40)** 3]
```

D I F

		40	45	50	55	60	65	70	75	80	85	90	95	100
	95	35	36	38	41	45	50	55	62	69	76	84	92	100
	90	33	34	35	38	41	45	49	53	57	60	64	66	68
	85	31	32	33	35	37	40	42	44	45	45	43	41	36
	80	30	30	31	32	34	35	35	35	33	29	23	15	5
	75	28	28	29	30	30	30	29	26	21	13	3	-10	-27
A	70	26	26	27	27	27	25	22	17	9	-2	-17	-36	-59
P	65	24	24	25	24	23	20	15	8	-3	-18	-37	-61	-91
T	60	22	22	22	22	20	15	9	-1	-15	-34	-58	-87	-123
	55	20	21	20	19	16	10	2	-11	-27	-50	-78	-112	-155
	50	19	19	18	16	12	6	-5	-20	-39	-65	-98	-138	-186
	45	17	17	16	14	9	1	-11	-29	-51	-81	-118	-164	-218
	40	15	15	14	11	5	-4	-18	-38	-64	-97	-138	-189	-250

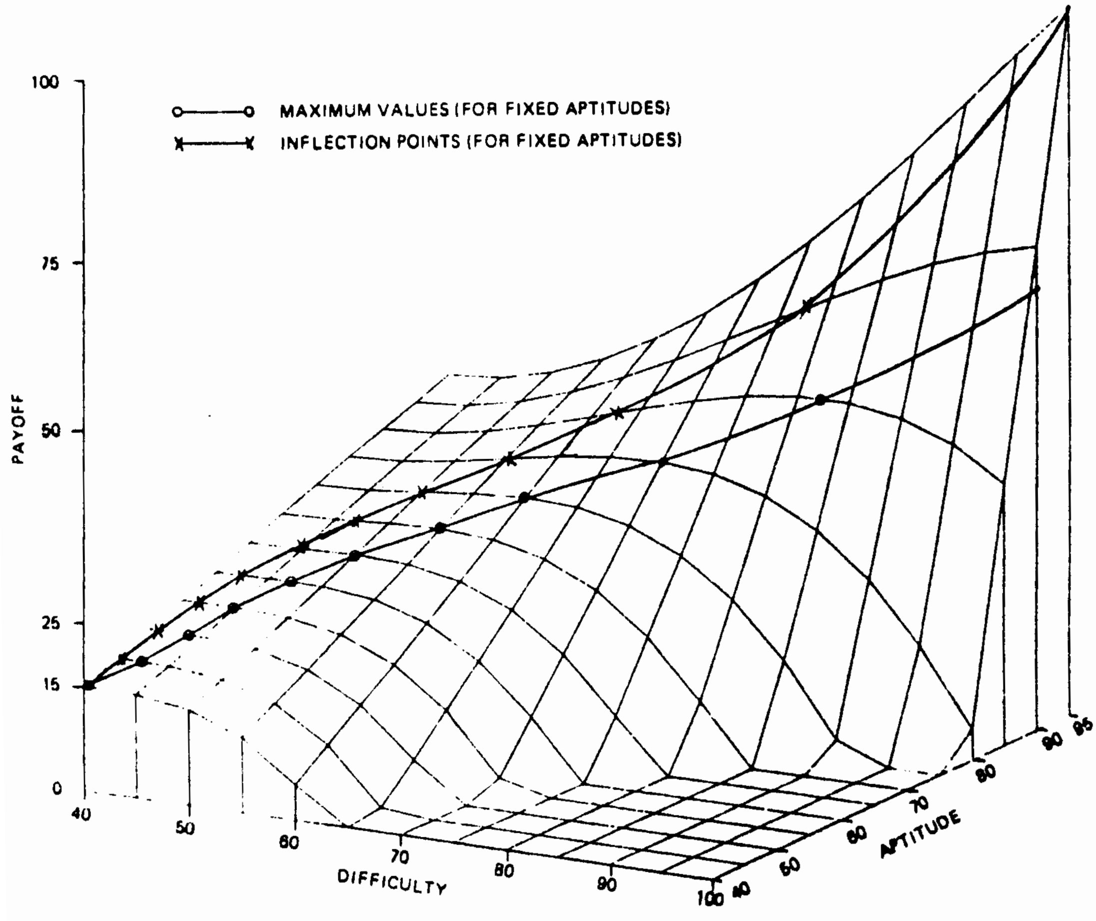


Figure 22. **Three-dimensional view of Model 3.**

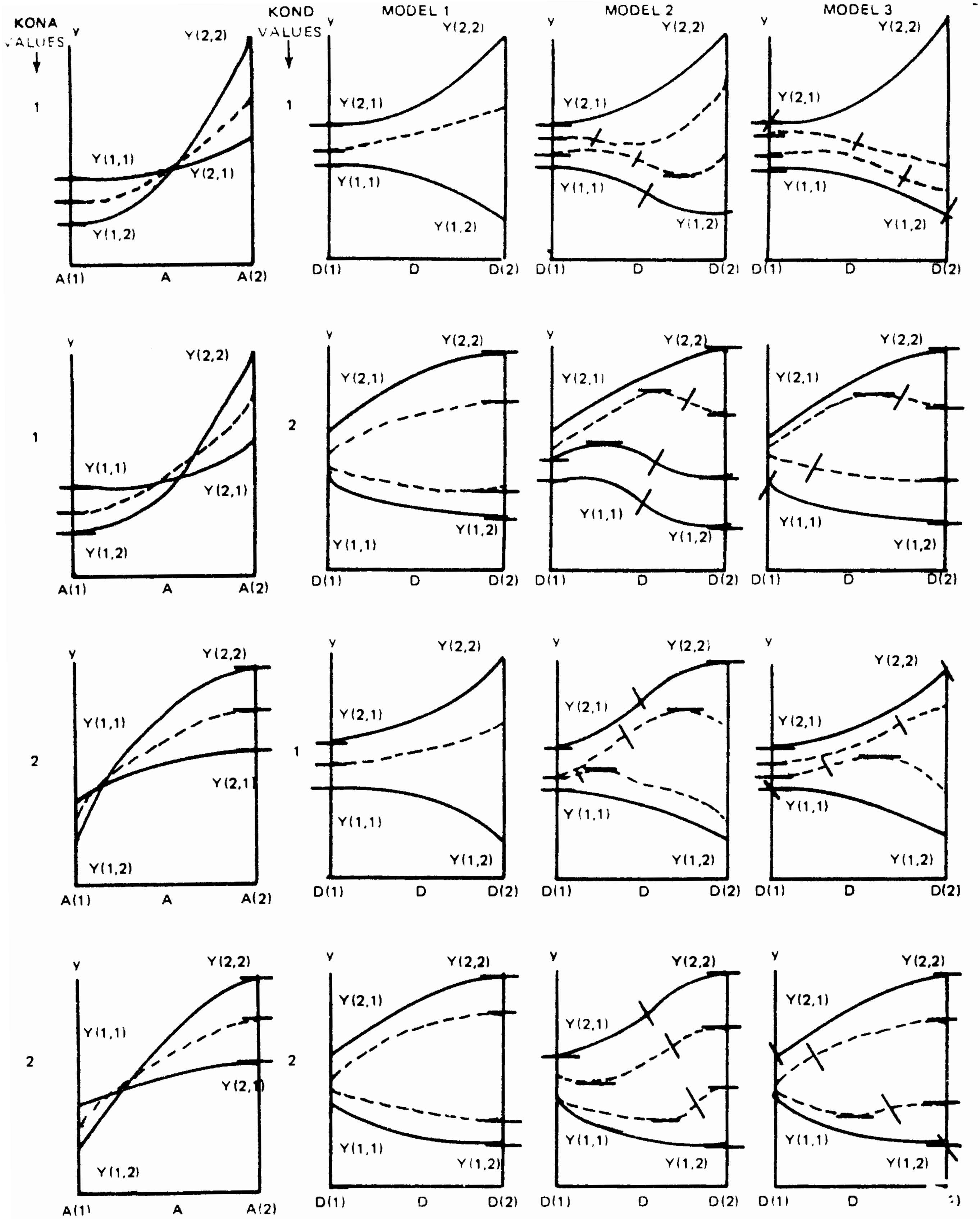


Figure 23. Combining and comparing Models 1, 2, and 3.

3. Y = 50 at Rank = 1 (high) and Preference = 1 (low); i.e., at A(1), D(1)

This requires

$$Y(1,1) = 50$$

4. Y = 25 at Rank = 15 (low) and Preference = 9 (high); i.e., at A(2), D(2). Then we set

$$Y(2,2) = 25$$

5. The values of Y will always be decreasing as values of Rank and Preference move away from Rank = 1 and Preference = 9. This implies the case of Model 1.

6. Near the highest value Y = 100 at Rank = 1 and Preference = 9 the Y values should decrease rapidly as Rank (variable A) increases for fixed Preference. The values will decrease slowly as Rank (A) approaches 15. This means that variable A will have a rapid change near A(1) and a slow change near A(2). This means that we should set

$$KONA = 2$$

7. Near the highest value Y = 100 at Rank = 1, Preference = 9 the Y values should decrease slowly as Preference (variable D) decreases for fixed Rank. The values will decrease rapidly as Preference (D) approaches the lowest value, 1. This means that variable D will have a rapid change near D(1) and a slow change near D(2). This requires the parameter setting

$$KOND = 2$$

8. The changes in Y values for Ranks near Rank = 15 should be slower (flatter) than the changes in Y values for Preferences near Preference = 9. Or another way to say this is that changes in Y values for Ranks near Rank =1 should be faster (steeper) than the changes in Y values for Preferences near Preference = 1. This implies that AEXP > DEXP. To express these statements, values for the parameters were set to

$$AEXP = 4$$

$$DEXP = 2$$

The output of this policy specification is shown as Table 14.

Figure 24 shows a graphical representation of the function.

This policy-specified model was used to determine the probabilities for simulating the choice of an applicant. The Y values for all 15 jobs were determined from the policy-specified function. Then the probability of selection was given by

$$\text{Probability for Job } i = Y_i / \sum_{i=1}^{15} Y_i$$

The entire process of policy-specifying this model required less than one-half day.

Table 14. **Y (Tendency to Choose a Job) = Function of Rank Order on List and Preference Rating**

```
MODEL=1

Y(1,1)=  50 Y(2,1)=    1 Y(1,2)= 100 Y(2,2)=   25
AEXP= 4 DEXP= 2 KONA= 2 KOND= 2
A(1)=   1 A(2)= 15 D(1)=   1 D(2)=   9
KSTARA=  1 KSTOPA= 15 KINCA=   1
KSTARD=  1 KSTOPD=   9 KINCD=   1

Y  =    25 + [< .1952-02>*(A -   15)** 4] + [<-.3750+00>*(D -    9)** 2]
           + [<-.1056-04>*[(A -   15)** 4]*[(D -    9)** 2]]
```

A (RANK)	D (PREFERENCE) 1	2	3	4	5	6	7	8	9
1	50	62	72	80	88	93	97	99	100
2	37	48	56	64	70	75	78	80	81
3	27	36	44	51	56	60	63	65	65
4	20	28	35	40	45	49	51	53	54
5	14	21	27	33	37	40	43	44	45
6	9	16	22	27	31	34	36	37	38
7	6	12	18	23	26	29	31	33	33
8	4	10	15	20	23	26	28	29	30
9	3	8	14	18	21	24	26	27	28
10	2	3	12	17	20	23	25	26	26
11	1	7	12	16	19	22	24	25	25
12	1	7	12	16	19	22	24	25	25
13	1	7	12	16	19	22	24	25	25
14	1	7	12	16	19	22	24	25	25
15	1	7	12	16	19	22	24	25	25

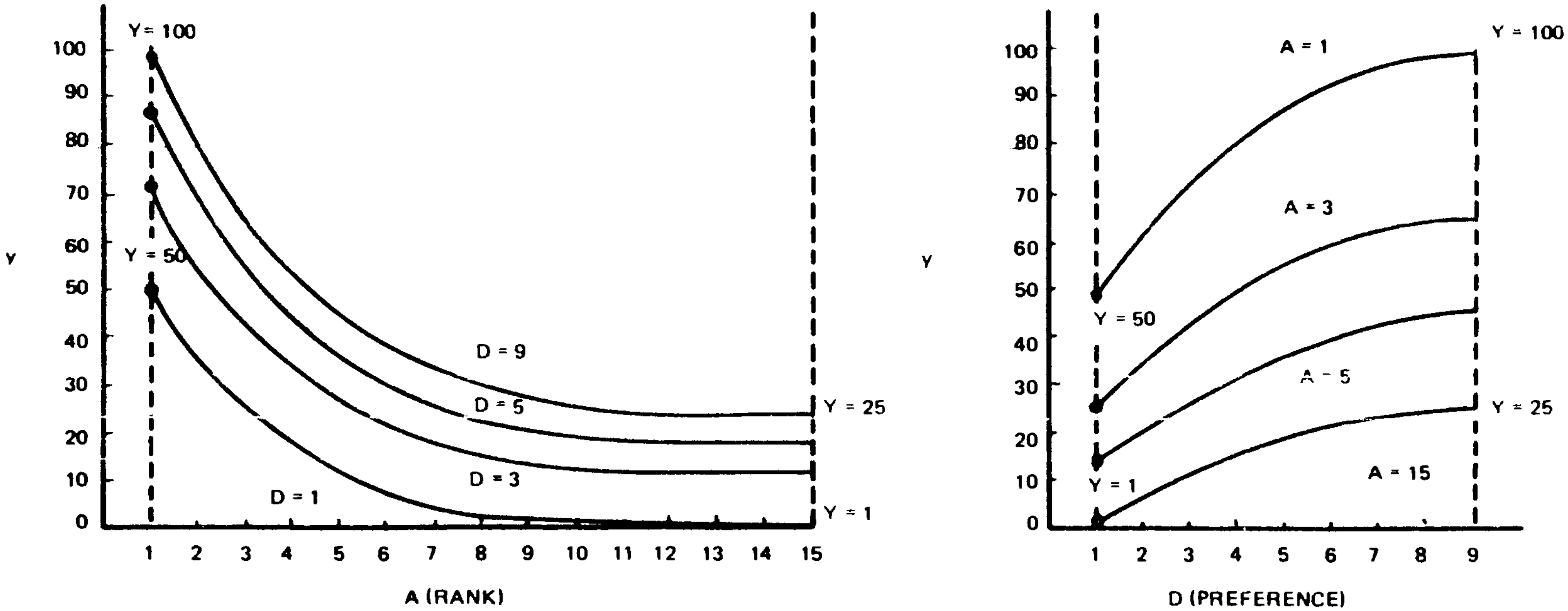


Figure 24. Y (tendency to choose) = function of A (rank) at preferences of 9, 5, 3, 1.
Y (tendency to choose) = function of D (preference) at ranks of 1, 3, 5, 15.

V. SUMMARY OBSERVATIONS

Policy-specifying has been shown to be a practical approach to obtaining implicit weights for information to be combined into a payoff value. Applications to new situations will continue to reveal the power of these models. Policy-specifying, combined with policy-capturing can provide a useful policy-development system. An on-line computer-based policy-development system should be implemented so that wide-spread use can be made of the process.

The policy-specifying models developed in this paper should be extended and improved to allow for easier use by the policy maker. The two-predictor models can be modified slightly to increase the power of the present system.

When it is desired to interact several variables, the two-variable models can be used repeatedly. For example, it might be appropriate to combine the Aptitude-Difficulty component—described in Example 1—in an interactive way with the Time-Fill component—described in Example 2. The resulting payoff generator would express a four-variable interaction among Aptitude, Difficulty, Time and Fill.

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