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The Selection of Dimensions when Choosing Between Multiattribute Alternatives[1]

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Abstract. The criterion – dependent choice model (Aschenbrenner, Albert & Schmalhofer, 1984) assumes that choice between two multidimensionally described alternatives is a sequential comparison process. The decision maker is assumed to select one dimension at a time and to compare the alternatives' standings on this dimension according to attractiveness. The resulting value differences are accumulated over the processed dimensions until enough evidence is accumulated so that the decision maker is convinced that one alternative is better than the other. This study concentrates on the process of sequentially selecting dimensions and its relation to judgments of the dimensions' importance. In three experiments the dimensional selection process was observed by different process tracing techniques. Although subjects displayed considerable variability in their dimensional selection over repeated choice tasks, this process was well described probabilistically by Luce's choice axiom. Parameters of dimensional importance which were inferred from the subjects' sequences of processing information agreed well with independently elicited judgments of the dimensions' importance when the judgments were obtained by a magnitude estimation procedure. Importance judgments obtained by rating scales showed worse agreement.

When choosing between two alternatives that are described by their features on a number of dimensions or attributes, people often do not consider all the available information about the alternatives; further, people appear to consider neither information on the same dimensions, nor even the same amount of information when choosing among different pairs of alternatives of the same kind, e.g., pairs of journal subscriptions (Schmalhofer, Albert, Aschenbrenner & Gertzen, 1986).

We tried to model this phenomenon by means of the criterion – dependent choice (CDC) model (Aschenbrenner, Albert & Schmalhofer, 1984). For binary choices among multidimensionally described alternatives, this model assumes that: a) people process information about the alternatives sequentially; b) people compare the alternatives with respect to the subjective evaluations of the alternatives's features on one dimension at a

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time; c) the results of these comparisons are accumulated over the processed dimensions; and d) this comparison stops and an alternative is chosen when a person has accumulated enough evidence to be convinced that one alternative is better, i.e., when the accumulated comparison results reach or exceed a critical value.

In this paper a special aspect within this model framework is analyzed in more detail, namely, the process of selecting the dimensions on which the choice alternatives are compared. We will consider two questions: a) How can an individual's process of selecting dimensions be described? and b) Are there relations between this selection process and independently elicited judgments of the importance of the dimensions?

As an example, Table 1 displays two subjects' sequences of processing dimensions when choosing between 15 pairs of journal subscriptions. Schmalhofer et al. (1986) showed that the resulting choices may be well described by the CDC−model when these selection sequences are known. Table 1 also demonstrates, however, that the subjects did not inspect the same dimensions for all choices. Rather, the inspected dimensions, their number, and their order vary from choice to choice. Furthermore, Table 1 displays some individual differences; for instance, the second subject appears to be much more variable than the first subject. Thus, under conditions where the sequence of inspected dimensions is not known, prediction of a subject's choices may fail even if an appropriate model is used and the subject's evaluations of the alternatives' features are known, simply because one does not know which dimensions are incorporated into the choice process.

Since, as Table 1 demonstrates, the processed dimensions often cannot be predicted with certainty, we tried to model this selection process probabilistically. The assumption that will be tested in this paper is that the selection process may be described by Luce's (1959) choice axiom. Let J denote the set of dimensions that have not been processed, i.e., initially J is the set of all dimensions; during the choice process the considered dimensions are successively removed from J. Then the choice axiom states that a subject's probability, p_{iJ}, for choosing a dimension i from set J for comparing the alternatives is

$$p_{iJ} = s_i / \sum_{j \in J} s_j, \qquad (1)$$

where s_i are parameters of the dimensions which are independent of the respective set J. Additionally, we assume that s_i are some function of the dimensions' importance for the subject in the given choice situation.

Although it has been shown repeatedly that the choice axiom usually does not hold for choices among multidimensional alternatives (Luce, 1977), there are reasons to consider it for the selection of dimensions, because dimensional importance is considered to be a one−dimensional continuum. Indeed, in an experiment where the subjects were presented with all information about pairs of alternatives simultaneously and no data about dimensional selection were collected, Aschenbrenner et al. (1984) obtained a reasonably good fit of subjects' choices for the CDC−model combined with Equation 1. In that study, it was additionally assumed that $s_i = \exp(w_i)$, where w_i was the importance that the subject independently assigned to dimension i using a 7−point rating scale. With this assumption, the CDC−model yielded better (probabilistic) predictions of the subjects' choices than the weighted additive model using all presented dimensions.

Table 1: Two subjects' sequences of inspecting alternatives' features on up to 11 dimensions when choosing between 15 pairs of journal subscriptions. The dimensions' names are given in Table 2

Choice pair	Sequence of inspected dimensions									Choice
	Subject 154, Experiment I:									
1/6	1	11	4	5	6					
3/8	1	11	4	6						
1/2	11	1	4	6	8	9				
5/6	1	11	4	5	6	7	8	9		
1/8	1	11	4	6						
5/3	1	11	4	5	6					
8/2	1	11	4	7	8	9				
3/1	1	4	11	10	7					
8/6	1	11	4	6	7	9				
2/3	1	11	4	6	7	8				
5/8	1	11	4	6	7					
6/2	1	4	11	8	9	7				
5/1	1	4	11	9	7	6				
3/6	1	11	4	5	6	7	8	9		
2/5	1	4	6	7						
	Subject 37, Experiment II with consequences:									
1/6	1	11	7	6	9	8				B
3/8	1	5	7	6	9					B
1/2	1	3	5	9	6	11				B
5/6	11	1	3	5	7	6	9	8		B
1/8	1	5	8	9	7	6	10	11	3	A
5/3	4	3	10	11	1	9	8			A
8/2	5	1	11	3	6	7	9	8		A
3/1	8	1	3							B
8/6	9	11	5	1	6	7				B
2/3	6	1	5	11						A
5/8	9	7	6	10	3	8	1	5		B
6/2	1	11	5	3	8					A
5/1	6	7	9	1	5					A
3/6	9	6	5	1	7	8	11			B
2/5	6	9	7	8	1	5				B

Here, we will analyse data from three experiments in which the subjects' sequences of selecting dimensions were directly observed. It will be tested whether the observed selection data are compatible with the choice axiom. The choice axiom also allows us to estimate the assumed parameters s_i from the selection data. These parameters will be compared with the subjects' explicit judgments of the dimensions' importance.

The first two experiments were originally conducted for a different purpose (Schmalhofer et al., 1986) and are reanalyzed here. The third experiment was especially designed for the purpose of this paper.

Experiments I and II (Reanalyses)

The two experiments which are reanalyzed here were identical except for an additional experimental variable in the second experiment and some additional tasks that are not of interest here. They are described in more detail in Schmalhofer et al. (1986).

In both experiments, the choice tasks consisted of choosing a one year subscription to a news magazine. Six descriptions of real journals were used as choice alternatives, each of which was described by its features on 11 dimensions. All possible pairs of alternatives were constructed, thus yielding a complete paired comparison with 15 choice pairs. An English translation of a sample choice pair is shown in Table 2.

Table 2: A sample choice pair as it would be seen by a subject who uncovered all 11 dimensions. (The dimensions' numbers were not given in the display.)

		alternative	
No.	Dimension	A	B
1	Frequency of publication	monthly	weekly
2	No. of articles on science	4	1
3	No. of advertisements	120	180
4	Price of magazine	6.- DM*)	4.- DM*)
5	No. of articles on politics	70	25
6	No. of articles on ecology	1	5
7	No. of articles on entertainment	5	3
8	No. of articles on cultural events	3	5
9	No. of pictures	15	15
10	No. of color pictures	10	3
11	No. of pages in magazine	350	300

*) DM: West German marks

Subjects first evaluated the importance of the 11 dimensions on 7-point rating scales which ranged from 1 (unimportant) to 7 (very important). These ratings were collected in random order and interspersed with attractiveness ratings of the alternatives' features on the dimensions.

Then the subjects were individually presented with the choice pairs on an information display board. While this display board always revealed the names of the dimensions by which the alternatives were described, the features of a choice pair had to be separately uncovered for every dimension. Thus, subjects had to successively request the alternatives' features on one of the dimensions until they wished to make a choice. At the beginning of every choice, subjects only saw the names of the 11 dimensions used to describe the alternatives. By opening a door on the display, the subject could then inspect a feature pair on a dimension which remained visible thereafter. After inspecting these features, the subject could request the features of another dimension. This procedure was repeated until a subject wanted to make a choice. Subjects were instructed to inspect as many feature pairs or dimensions as they liked before making a choice. The journals' names were not revealed to the subjects. The choices and the selected dimensions were recorded. Two sample protocols are shown in Table 1.

Whereas all the choices were hypothetical in the first experiment, half of the subjects received a free copy of the journal they had chosen in a randomly selected pair in addition to their payment at the end of the second experiment. This was announced to the respective subjects before they made their choices.

Subjects were students from the University of Heidelberg, who were paid 10 German marks per hour. Twenty-eight subjects participated in Experiment I; Experiment II had 21 subjects without consequences and 21 subjects who additionally received a copy of a chosen journal as a consequence.

Results

Fitting the choice axiom. The s_i parameters of the dimensions were estimated individually from each subject's 15 orders of inspecting dimensions by an iterative maximum likelihood algorithm described by van Putten (1982). This algorithm allows us to estimate all s_i values simultaneously according to Equation 1. This is accomplished by determining the subsets of dimensions that occur in a subject's processing orders, and by counting how often each dimension is chosen from each subset. The first subset of the first subject in Table 1 is, of course, the set of all dimensions which occurs as the first set in every choice problem, i.e., 15 times. From this set Dimension 1 was chosen 14 times, and Dimension 11 was chosen once. The next subset is the set of all dimensions except Dimension 1 which occurs 14 times. From this set there were ten choices of Dimension 11 and four choices of Dimension 4. Next, the set without Dimensions 1 and 11 occurs 11 times, and Dimension 4 was always chosen from this set, and so on. Two dimensions (2 and 3) were never inspected. In toto, the selection sequences of Subject 154 yield 21 different subsets from which 84 dimensional selections were observed.

The frequencies of the subsets and the frequencies with which dimensions were chosen from the subsets provide the input values for van Putten's algorithm. The algorithm converged to the limits of the computer's accuracy within 10 to 200 iterations for most subjects.

Most subjects (21 out of 28 in Experiment I, 16 out of 21 in both conditions of Experiment II) had some (1 to 8; 2.5 on average) dimensions which they never inspected. In these cases the respective dimensions received s_i – values of zero in advance – in accordance with the choice axiom. These dimensions were not considered for model fitting, nor were they considered in the subsequent likelihood ratio tests.

Furthermore, about one third of the subjects (9 in Experiment I, 8 and 6 in Experiment II with and without consequences) had a few (1 to 3; 1.9 on average) dimensions which they always inspected first in a fixed order. These dimensions were also excluded from parameter estimation and testing.

Both exclusions are conservative, since the choice axiom can perfectly account for these cases by assigning zero parameters to neglected dimensions, and arbitrarily large – theoretically infinite – parameters to dimensions that are always chosen first. Thus, these exclusions decrease rather than increase model fit.

A likelihood ratio for testing the choice axiom with the estimated parameters against the unrestricted model was calculated for each subject by the formulas supplied by van Putten (1982). These likelihood ratios were transformed into asymptotically distributed χ^2 (Chi – square) values ($\chi^2 = -2*\log(LR)$) for testing model fit. Since the degrees of freedom for the test depend on the number and sizes of the subsets of dimensions of a subject which further depend on the subject's variability and on the number of processed dimensions, the degrees of freedom strongly vary between subjects. Therefore, as a summary statistic we report only the distribution of probabilities of χ^2 over subjects, that is, the probabilities of the observed selection orders under the assumption that the model holds.

Table 3 displays some percentiles of the distributions of these probabilities for the two experiments. More specifically, Table 3 displays the median, the 3rd and 1st quartile, and the 95th and 5th percentile of the distributions of probabilities of χ^2 over subjects. If the choice axiom holds, one would expect the percentile values to be identical to their percentiles, i.e., the median should be at about .50, the 95th percentile value should be .95, etc. From Table 3 it is seen that the fit of the choice axiom to the selection data is even better than this. For instance, for 50% of the subjects in Experiment I $p(\chi^2)$ is greater than .998.

Table 3: Selected percentiles of the distribution of $p(\chi^2)$ over subjects

Exp. no.	Conse- quences	Percentile 95%	75%	50%	25%	5%
Exp.I	without	1.0	.99998	.99855	.81715	.354
Exp. II	with	1.0	.99999	.99986	.97813	.140
	without	1.0	.99999	.99965	.97605	.249
	together	1.0	.99999	.99986	.97605	.143
Exp. III	with	.99	.92	.70	.40	.015
	without	.98	.64	.31	.09	.022
	together	.99	.88	.50	.19	.020

Table 4: Frequencies of inspecting each dimension in each order position (upper entries) and frequencies predicted from the s_i values (lower entries) for the selection sequences in Table 1. (The table shows, for instance, that Subject 37 inspected Dimension 1 as the first dimension in five choice tasks, whereas the BTL–model would predict this for 4.42 choice tasks.)

Subject 154: χ^2=64.92, df=101, p=.998

Dimen- sion	Position in selection sequence 1	2	3	4	5	6	7	8	si
1	14	1	0	0	0	0	0	0	482.8026
	14.03	0.97	0.00	0.00	0.00	0.00	0.00	0.00	
4	0	4	11	0	0	0	0	0	11.4479
	0.33	4.80	9.87	0.00	0.00	0.00	0.00	0.00	
5	0	0	0	4	0	0	0	0	0.1316
	0.00	0.06	0.14	1.41	1.14	1.26	0.00	0.00	
6	0	0	1	6	4	1	0	0	0.5360
	0.02	0.23	0.56	5.70	3.69	1.82	0.00	0.00	
7	0	0	0	2	5	3	0	0	0.3474
	0.01	0.15	0.36	3.71	3.81	1.96	0.00	0.00	
8	0	0	0	1	2	1	2	0	0.1545
	0.00	0.07	0.16	1.65	1.72	1.37	1.02	0.00	
9	0	0	0	1	1	3	0	2	0.1295
	0.00	0.05	0.14	1.38	1.45	1.36	0.86	1.76	
10	0	0	0	1	0	0	0	0	0.0178
	0.00	0.01	0.02	0.19	0.20	0.23	0.12	0.24	
11	1	10	3	0	0	0	0	0	20.7714
	0.60	8.67	3.76	0.96	0.00	0.00	0.00	0.00	
Sum	15	15	15	15	12	80	2	2	

Table 4 is continued on the next page.

Subject 37: χ^2=193.45, df=363, p=.999989

Dimension	1	2	3	4	5	6	7	8	9	si
	Position in selection sequence									
1	5	4	0	3	2	0	1	0	0	4.577
	4.42	3.30	2.24	2.63	1.32	0.51	0.57	0.00	0.00	
3	0	2	2	2	1	0	0	0	1	0.823
	0.80	0.97	1.06	1.07	1.07	1.04	0.69	0.39	0.92	
4	1	0	0	0	0	0	0	0	0	0.071
	0.07	0.08	0.10	0.11	0.14	0.15	0.11	0.17	0.08	
5	1	2	5	1	1	1	0	1	0	2.114
	2.04	2.33	2.35	1.28	1.34	1.46	0.58	0.62	0.00	
6	3	1	1	2	3	2	0	0	0	2.083
	2.01	1.99	2.25	2.19	2.14	1.10	0.32	0.00	0.00	
7	0	2	3	0	3	2	0	0	0	1.487
	1.43	1.75	1.91	1.56	1.84	1.28	0.23	0.00	0.00	
8	1	0	1	1	1	3	1	2	0	0.937
	0.91	1.04	1.26	1.39	1.60	1.59	0.73	1.49	0.00	
9	3	1	1	2	2	1	2	0	0	1.952
	1.89	1.87	2.17	2.15	1.70	1.01	1.22	0.00	0.00	
10	0	0	1	1	0	0	1	0	0	0.252
	0.24	0.30	0.37	0.39	0.46	0.48	0.37	0.40	0.00	
11	1	3	1	2	0	1	1	1	0	1.232
	1.19	1.37	1.31	1.25	1.39	1.37	1.19	0.94	0.00	
Sum	15	15	15	14	13	10	6	4	1	

This extreme fit is observed for both experiments with hardly any differences between them nor between the two conditions of Experiment II. There is only one subject (Experiment II with consequences) for whom the choice axiom was clearly violated (χ^2 = 181, df=96, p=0.0). Some of the selection sequences of this subject were cyclic permutations of others. This subject thus demonstrates that the choice axiom is not trivially fullfilled for the kind of task used here. Thus, we can conclude that the choice axiom can very well explain the subjects' sequences of inspecting dimensions. Table 4 gives a more intuitive demonstration of the fit by showing for the data from Table 1 how often each dimension was inspected in each rank position and how often these positions were predicted by the choice axiom.

We also calculated the likelihood ratio for the estimated si−values as compared to the choice axiom assuming the s_i−values are equal for all dimensions. For all but three subjects, equal parameters explained the data significantly ($p<.01$) worse than the estimated parameters. On average the observed selection sequences were $5*10^{23}$ more likely under the estimated parameters than under equal s_i−values. This demonstrates that the estimated parameters are meaningful; the choice axiom is not trivially fulfilled with any parameters.

Despite the size of the fit, however, the absolute values of the likelihood ratio tests should be considered with care, because many of the expected frequencies of selecting dimensions from subsets that were entered into the tests were close to zero. In order to meet the usual criterion that all expected frequencies should be at least 5, we would have needed about 50 times as many selection sequences per subject. Thus, the goodness of the χ^2 approximation appears questionable here. This problem is addressed in Experiment III which used a pair comparison method in order to get higher expected frequencies.

Importance judgements. The second question of interest is whether the subjects' sequences of selecting dimensions have any relation to their judgments of the dimensions' importance that were independently elicited. According to Aschenbrenner et al.'s (1984) assumption, the logarithms of the s_i–values were correlated with the importance ratings of the dimensions, w_i, individually for each subject. In order to get s_i–values for all dimensions including those that were neglected or inspected in a fixed order, the estimation procedure was slightly modified by adding a small fraction (1/11) to all dimensions' absolute choice frequencies of the respective subjects. This is a commonly used procedure which does not change the order of parameters but which yields finite ratios of parameters for all pairs of dimensions.

Table 5 displays the distributions of the resulting product–moment–correlations[2] between $\log(s_i)$– and w_i–values over subjects. Although most of the correlations are positive, showing at least some relation between judged importance and dimensional selection, it is also obvious that this relation is not overwhelmingly strong. This is also demonstrated in Figure 1 which graphically displays the relation for the "best" and an average subject from Experiment I. In general, the correlations appear to be too low to reliably predict dimensional selection from judged importance.

Table 5: Minimum, maximum, and quartiles of the distribution of correlations between s_i and w_i over subjects

Exp. no.	conse- quences	Max.	3.Qu.	Median	1.Qu.	Min.
Exp.I	without	.86	.64	.52	.26	-.31
Exp. II	with	.91	.65	.41	.22	-.26
	without	.91	.41	.17	.04	-.19
Exp. III	with	.99	.97	.88	.78	.32
	without	.99	.96	.94	.88	.69

2) Rank order correlations were also calculated. They were generally somewhat lower (by .05 to .10) but otherwise showed the same pattern of results.

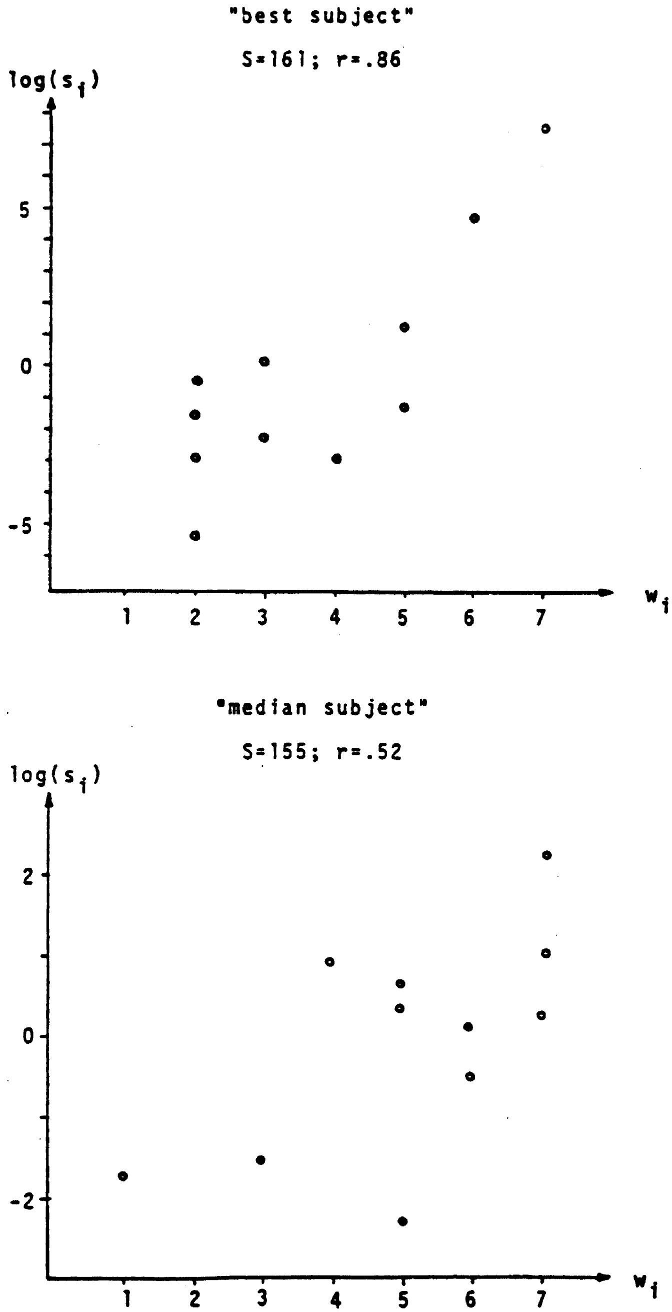

Figure 1: Plots of the relation between log(s_i) and judged importance, w_i, for the "best" and an average subject in Experiment 1

Experiment III

Since we suspected that low expected frequencies may be partly responsible for the superficially good fit of the choice axiom in the reanalyses, a new experiment was especially designed to directly collect selection data between pairs of dimensions. Further, another method for eliciting importance judgments, namely the method of magnitude estimation, was applied.

Method

Subjects. Subjects were 40 students of the University of Heidelberg who responded to a notice in the cafeteria asking for volunteers who liked to play board games.

Design and procedure. Choice alternatives were board games which had been newly published in 1984, so that not many subjects could be expected to know or have the games. The games were described on 13 dimensions, such as required skills, number of participants, chance/strategy ratio, etc. In order to keep the time for the experiment within reasonable limits and to avoid dimensions that were totally irrelevant to a subject, each subject chose his/her eight most important dimensions from a list of all 13 dimensions at the beginning of the experiment. Only these eight dimensions were used for the respective subject.

The main part of the experiment was run under the control of an apple II computer. The computer selected a pair of games and then offered the subjects a pair of dimension names. The subjects had to select one dimension on which they were informed about the alternatives' features. Then the subjects were allowed to choose between the two games on the basis of this information or to ask for more information. In the latter case, the computer selected a new pair of dimensions, and so on. When the subjects had requested seven dimensions for the given choice pair, they were only asked either to make a choice or see the last dimension. All answers were given by two buttons. After seeing the last dimension the subjects had to choose one of the two games. Whenever subjects chose a game the procedure continued with a new pair of games. This was continued until each of the 28 pairs of dimensions had been offered to the subjects at least 20 times.

For a given pair of games, the information already displayed remained visible until the subject chose one of the games. Consequently, only pairs of those dimensions were offered which were not already displayed on the screen. Among these pairs of dimensions the computer always selected the pair which had been least often presented. If there was more than one pair with the same minimum number of former presentations, the computer selected one of these pairs at random. Since the number of presentable pairs becomes more and more restricted the more dimensions are already displayed for a given game pair, some dimension pairs had to be presented more than 20 (up to 30) times to some subjects who tended to request more than four dimensions per choice pair on average.

By this procedure some alternatives' idosyncratic feature combinations were learned fast, so that some alternatives could be recognized after seeing a few features when they occurred again. Therefore, 'pseudo-alternatives' were interspersed which consisted of random combinations of the games' features. Each alternative in a pair was replaced by a pseudo with .3 probability. Thus, on the average only every second (.7x.7=.49) choice pair consisted of two real games.

After the choices the dimensions' importance evaluations were elicited by a magnitude estimation procedure. Subjects first rank ordered the eight dimensions. Then a value of 10 was assigned to the least important dimension, and the subjects had to judge how much more important each other dimension was.

The experiment lasted for about three hours with a coffee break after 1.5 hours. Half the subjects, i.e., 20, were paid 10 German marks per hour for participation and experienced no further consequences of their choices. The other half received no pay but were informed that, as all games occurred more then once, they would receive the game they chose most often. The games were worth between 40 German marks and 60 German marks.

Results

Fitting the choice axiom. The si-values were estimated from the pairwise dimensional selection data by maximum likelihood. The distributions of the probabilities of Pearson's χ^2-values over subjects are shown in the last three rows of Table 3. The correspondence between the percentiles and their actual values suggests that the choice axiom provides a good description of the selection of information for choosing.

Table 3 also suggests that in this experiment the fit of the choice axiom is higher for subjects with consequences than for those without. The difference is significant by a Mann-Whitney-U-Test ($z=2.29$, $p=.022$).

Importance judgments. The s_i-parameters derived by the choice axiom are usually considered to have ratio scale level, whereas magnitude estimates are assumed to have log-interval scale level (Krantz, Luce, Suppes & Tversky, 1971, pp. 164-166). If both s_i and w_i are measures of the same underlying importance continuum then the logarithms of the two scales should show a linear relation. Indeed, we found the product-moment correlations between $\log(s_i)$ and $\log(w_i)$ generally higher than those between s_i and w_i, between $\log(s_i)$ and w_i, and between s_i and $\log(w_i)$. They were also higher than rank correlations.

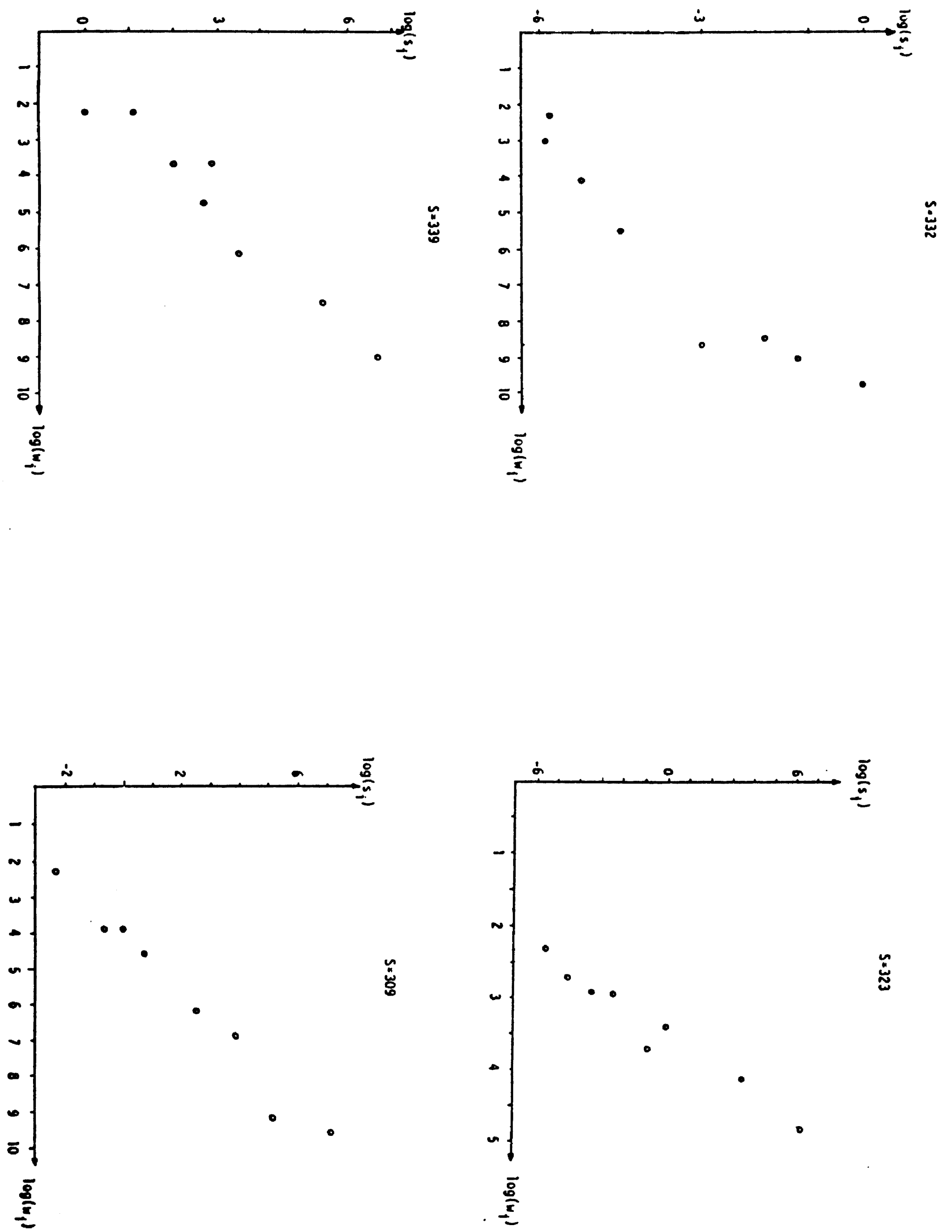

Figure 2: Plots of the log(s_i) – log(w_i) – relation for four subjects from Experiment III.

The last two rows of Table 5 reveal that in general the relations between the magnitude estimates of importance and the s_i-parameters were much higher in this experiment than they were in the first two experiments. Figure 2 gives a few graphical examples of this relation.

Discussion

By the reanalyses of data from two experiments and by a third experiment we pursued two questions that emerged from studies on the CDC-model: 1.) How do people select dimensions for comparing multiattribute alternatives? 2.) What is the relation between the dimensional selection process and subjects' importance judgments of the dimensions?

With respect to the first question, the results of the three studies appear unanimous. Dimensions were selected and processed in sequences that are well described probabilistically by Luce's choice axiom. Although people do not use the same number or sequence of dimensions when choosing among different pairs of alternatives from the same field, the selection process may be described in orderly and simple ways probabilistically. This appears to be a robust finding in consideration of the differences in design and procedure of the three experiments.

Additionally, Experiment III found an effect of consequences. Subjects expecting consequences for their choices acted more in accordance with the choice axiom than subjects choosing only hypothetically. We assume that the increased personal interest of the subjects with consequences resulted in more consistent behavior. However, we did not find a consequence effect in Experiment II. This may be due to the minor role of consequences in Experiment II as compared to Experiment III. In Experiment II subjects obtained a copy of a journal in addition to their payment, whereas in Experiment III subjects received a much more valuable game as their only payment. On the other hand, a comparison of the groups with and without consequences in Experiment II appears rather doubtful due to the inflated size of the fit probabilities.

This latter problem of inflated probabilities is currently being addressed in an experiment in which higher numbers of selection sequences are elicited.

With respect to the second question, how these internal importance measures are related to explicit judgments of importance, the results were less unanimous. Although all three experiments yielded positive relations for most subjects, only the third study provided relations of satisfactory magnitude. Thus, we have shown that a high agreeement between judgments and behavioral information processing can be obtained.

In toto, there are three differences between the first two and the third experiment which may be responsible for the different results and deserve further consideration.

First, instead of journals, board games were used as the choice topic of the third experiment. This explanation is not a very likely candidate, because our former studies on the CDC–model (e.g., Aschenbrenner et al., 1984; Schmalhofer, Aschenbrenner, & Albert, in prep.) showed that the given topics did not affect the experimental results.

Secondly, importance judgments were elicited before the choices in the first two experiments whereas they were obtained after the choices in the third experiment. It appears plausible that during the occupation with the choice alternatives the subjects' may have modified their opinion about the importance of the dimensions in accordance with the experienced variation of the alternatives on these dimensions. However, our previous attempts to manipulate subjects' importance judgments by presenting them with systematically designed alternatives were not successful.[3]

The third difference is one of scaling procedure. Seven–point rating scales were used to assess importance in the first two experiments, whereas magnitude estimation was used in the third experiment. Inspection of Figure 1 suggests that floor effects and the restricted number of categories of the rating scales may be responsible for part of the lack of agreement between selection sequences and importance ratings. In addition, the magnitude estimation procedure, as it was used here, elicited relative judgments, whereas the ratings were absolute judgments. Thus, the difference in scaling procedures appears to be the main reason for the differences in the association between importance judgments and s_i–values.

Although the questions investigated in this paper were originally derived from studies of the CDC–model, we consider the results to be of more general importance. Luce's choice axiom may be considered one of the fundamental principles in mathematical psychology. Thus, after its rejection as a general law of multidimensional choice, its role in a subprocess of the choice process is noteworthy. Additionally, the results show that the parameters derived by the choice axiom may have psychological significance. Further, importance judgments play a significant role in a variety of other fields, for instance, in decision aiding procedures. However, their reliability and validity is still discussed (e.g., Schoemaker & Waid, 1982; Stillwell, Seaver & Edwards, 1981). According to our results, observing information processing appears to be a promising method for validating importance judgments. Finally, the relevance of the results to any theory of choice behavior which assumes sequential information processing (Payne, 1982) is obvious.

3) One of us (Aschenbrenner) conducted a number of unpublished experiments in which subjects had to evaluate dimensional importance (by ranking and mgnitude estimation) before and after making choices. Choice alternatives were adaptively designed to show highly restricted variation on some dimensions (for instance, the most or an intermediately important dimension of a subject) as compared to other dimensions. Surprisingly, these experiments found hardly any and no systematic differences between the importance judgments made before and after the choice tasks.

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