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A MARKOVIAN MODEL OF INDIVIDUAL CHOICE BEHAVIOR[1)]

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Selective as well as complete information processing has been postulated for individual choice behavior. Well known heuristics of the selective type are the satisfycing principle, the elimination by aspects rule and the rules of the lexicographic type. Choice heuristics which assume complete information processing are, for instance, those of the family of Additive-Difference Models.

Our goal is to find a general process model for choices which allows for partial as well as for complete information processing. The model consists of three components.

First: The sequential processing component.
Second: The aggregation of evaluations component.
Third: The termination component.

By specifying assumptions about each of these components special models will be obtained for calculating choice probabilities; we will use a simplified example in order to explain how the model works.

The choice task may be to choose two out of three job applicants as teaching assistents. The persons may be described on four dimensions.

insert figure 1 here

This example may be used for demonstrating how the three components of our model interact.

First. The sequential processing component

Since the applicants are described on dimensions we assume sequential processing of the dimensions. The sequence of dimensions may vary depending on importance. At every moment the process is in one state, which is defined by the dimensions already processed. That is, the state space of the model is defined by all possible subsets (combinations) of the - in our case - four dimensions, including the empty set as the starting set (i.e., the power set of dimension).

insert figure 2 here

Then the transition matrix is given by

insert figure 3 here.

Transitions are possible only to the same state (by repeating an already processed dimension) or into those other states which include just one additional dimension from those which haven't been processed so far.

In our example it is assumed that dimension (a) is always processed first; thereafter the remaining dimensions have an equal chance of being processed next. It is assumed that the selection of dimensions occurs without replacement. These transition probabilities are displayed in figure 4.

insert figure 4 here

Second: The aggregation of evaluations component

While processing a dimension, the features on the dimension are evaluated and the evaluations are aggregated. Within the present framework different aggregation rules which have been discussed in the literature - may be as umed. For example, decision makers may count the number of attractive features per alternative; or they may consider only the relatively best feature of every dimension and count the number of such features for every alternative.

In our example it is assumed that for each alternative it is counted how many alternatives are worse on the considered dimensions. After processing of dimension (a) the counter for alternative (x) would thus be 1(because only one alternative, namely z, is worse than x on dimension a).

insert figure 5 here

If the dimension (a) were processed first and (c) thereafter the counter for x would be 3. This result is obtained by simply applying the assumed aggregation rule.

By this, to each state a vector of the aggregation results is assigned.

insert figure 6 here

The last component which must be discussed is the termination of the process.

Third: The termination component

A termination rule allows for stopping the process and choosing before all features of the alternative have been processed. Termination assumptions may be, for instance: Stop, after n dimensions have been processed; stop, after a particular set of features has been processed; stop when the aggregated evaluations reach some absolute criterion. Each of these and other termination rules can be accounted for within the present framework by making states which satisfy the specified termination role absorbing states. A preference order of alternatives is assigned to these states on the basis of the aggregation vector and the termination rule.

Again, a very specific termination rule will be considered in our example. It may be assumed that the alternatives are chosen when the counters of two alternatives exceed the third one by at least a value of two. This happens for the states (a, c), (b, d) and (a, b, d). These states are therefore absorbing states.

insert figure 7 here

In state (a, c) the alternatives x and y will be chosen;
the same alternatives would be chosen in state (b, d) if it could be reached.
In state (a, b, d) the alternatives y and z will be chosen.

An additional specification is needed to ensure that an absorbing state will be reached eventually, even when the counters of two alternatives never exceed a third one by two. This will be done by making (a, b, c, d) an absorbing state; in the case that all dimensions are processed the two relatively best alternatives would be chosen, that is y and z.

Whereas, the example presented above suggests that the application of the model may be restricted to dimensionally described alternatives, its range of application is actually broader. The information units about alternatives may also be processed in the form of more or less idiosyncratic features which are not readily organized by dimensions. For instance, one may associate the following features with 'Heidelberg': Student prince, Philosophers' Path, Neckar, castle. In such cases the states of the model will be defined by the features that have already processed. In chosing between 'Heidelberg' and some other tourist centres for a pla the retrieval of features from memory may determine the transition probabilities between the states.[1]

The presented framework incorporates many choice models as special cases - stochastic as well as deterministic models - which were previously investigated separately. Consequently, there emerges the question for situational and individual factors that determine the specifications of the model components.

The sequential processing of information units may depend on the mode of presenting alternatives (e.g., simultaneous dimensional description in matrix form, sequential offering of features, continuous prose, pictures), on the salience or importance of information units, or on availability from memory (e.g., for alternatives presented by their names). The applicability is

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[1] Schmalhofer, F., Aschenbrenner, K.M. & Albert, D., Partial information processing of binary choice alternatives presented by name or description. Manuscript, Heidelberg, Februar 1984.

restricted, however, by the assumption, that transition probabilities depend only on combinations of already processed units, irrespective of the sequence in which they were processed.

The evaluation and aggregation component may, for instance, depend on whether the choice task requires choice quality on a relative or absolute level and on the number of offered alternatives.

The termination component allows for the differentiated consideration of such aspects as time restrictions, quality requirements, processing effort. Consistent complete information processing is described by defining only that state as absorbing in which all information units have been processed.

The general framework allows to model, among others, intransitive choices, inconsistency in repeated choices, and oscillation in tentative preferences. Moreover, with additional assumptions about time requirements for subprocesses, choice latencies and probability-latency functions may also be predicted by the models.

		x	y	z
(a)	grade point average	4.o	4.5	3.5
(b)	competence in presenting a paper	low	high	very high
(c)	number and quality of published research	much more	more than	as usual
(d)	teaching experience	some	a good deal	a great deal

Fig. 1.

$\{\ \}$

$\{a\}$
$\{b\}$
$\{c\}$
$\{d\}$

$\{a, b\}$
$\{a, c\}$
$\{a, d\}$
$\{b, c\}$
$\{b, d\}$
$\{c, d\}$

$\{a, b, c\}$
$\{a, b, d\}$
$\{a, c, d\}$
$\{b, c, d\}$

$\{a, b, c, d\}$

Fig. 2 .

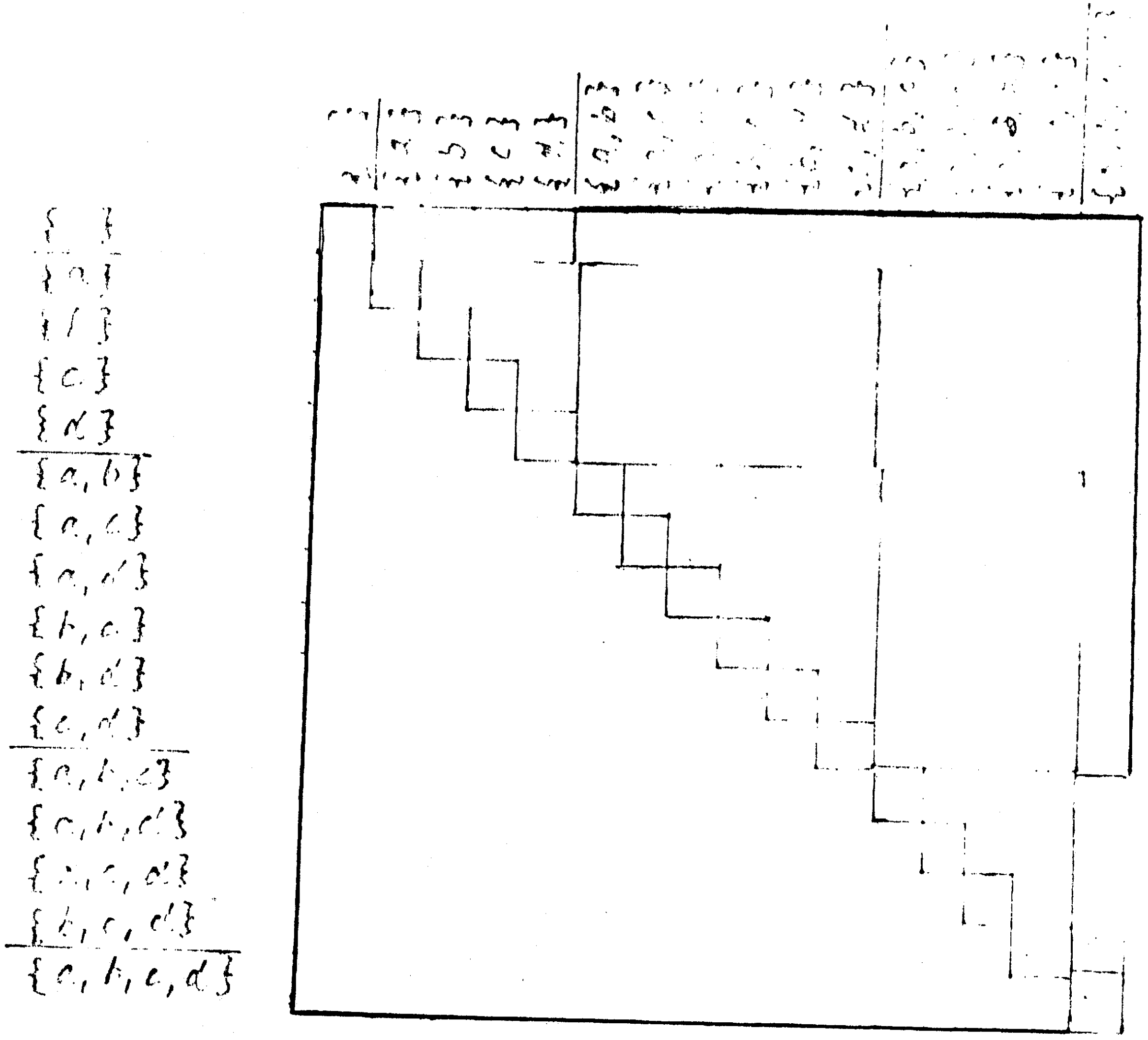

Fig.3 .

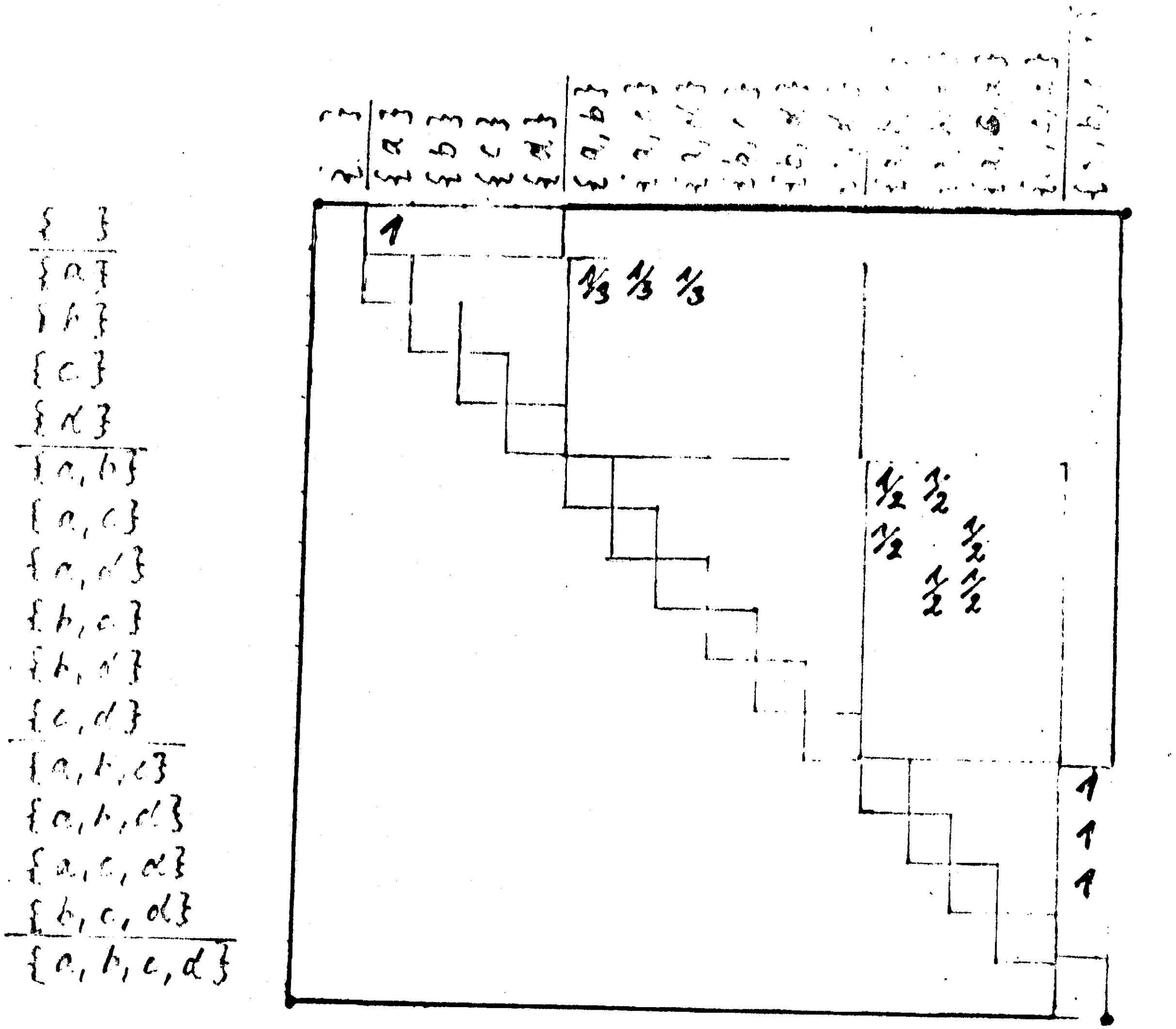
{ }
{a}
{b}
{c}
{d}
{a,b}
{a,c}
{a,d}
{b,c}
{b,d}
{c,d}
{a,b,c}
{a,b,d}
{a,c,d}
{b,c,d}
{a,b,c,d}
1
1/3 1/3 1/3
1/2 1/2
1/2 1/2
1/2 1/2
1
1
1

Fig. 4.

x	y	z	
0	0	0	$\{\ \}$
1	2	0	$\{a\}$
0	1	2	$\{b\}$
2	1	0	$\{c\}$
0	1	2	$\{d\}$
1	3	2	$\{a,b\}$
3	3	0	$\{a,c\}$
1	3	2	$\{a,d\}$
2	2	2	$\{b,c\}$
0	2	4	$\{b,d\}$
2	2	2	$\{c,d\}$
3	4	2	$\{a,b,c\}$
1	4	4	$\{a,b,d\}$
3	4	2	$\{a,c,d\}$
2	3	4	$\{b,c,d\}$
3	5	4	$\{a,b,c,d\}$

Fig. 5.

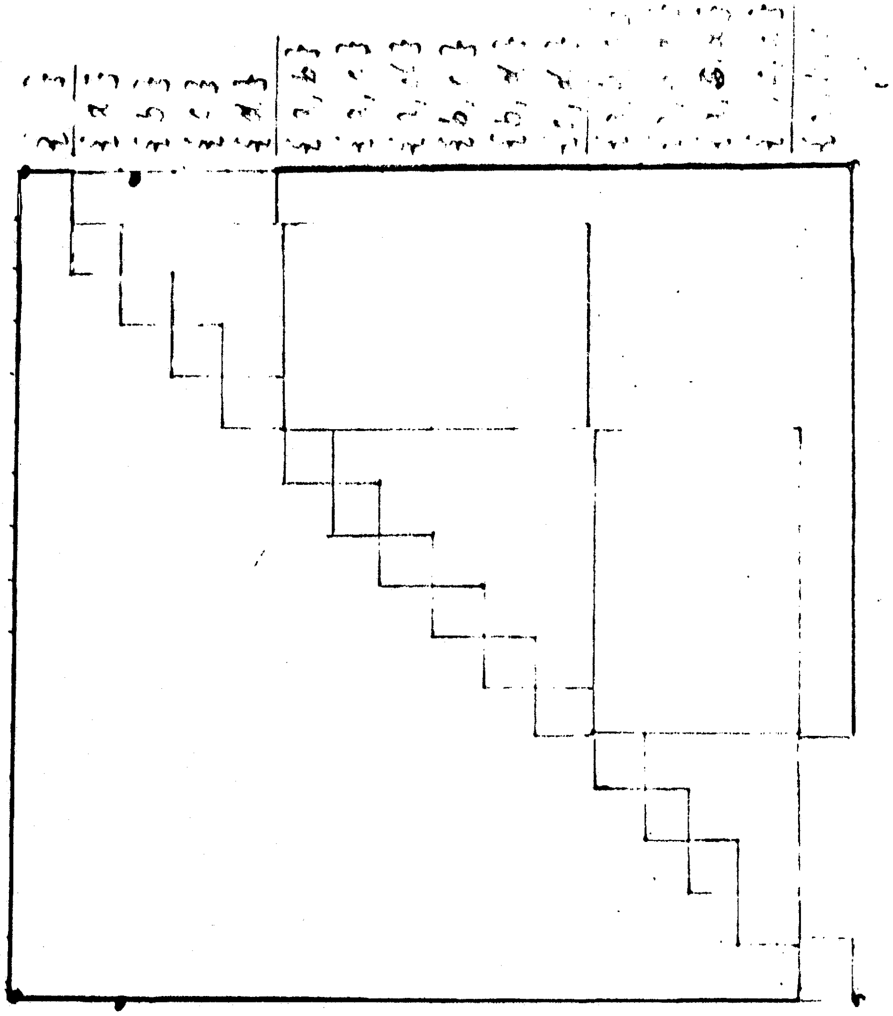

Fig. 6.

x	y	z		
0	0	0		{ }
1	2	0		{a}
0	1	2		{b}
2	1	0		{c}
0	1	2		{d}
1	3	2		{a, b}
3	3	0	$(x, y; z)$	{a, c}
1	3	2		{a, d}
2	2	2		{b, c}
0	2	4	$(y, z; x)$	{b, d}
2	2	2		{c, d}
3	4	2		{a, b, c}
1	4	4	$(y, z; x)$	{a, b, d}
3	4	2		{a, c, d}
2	3	4		{b, c, d}
3	5	4	$(y, z; x)$	{a, b, c, d}

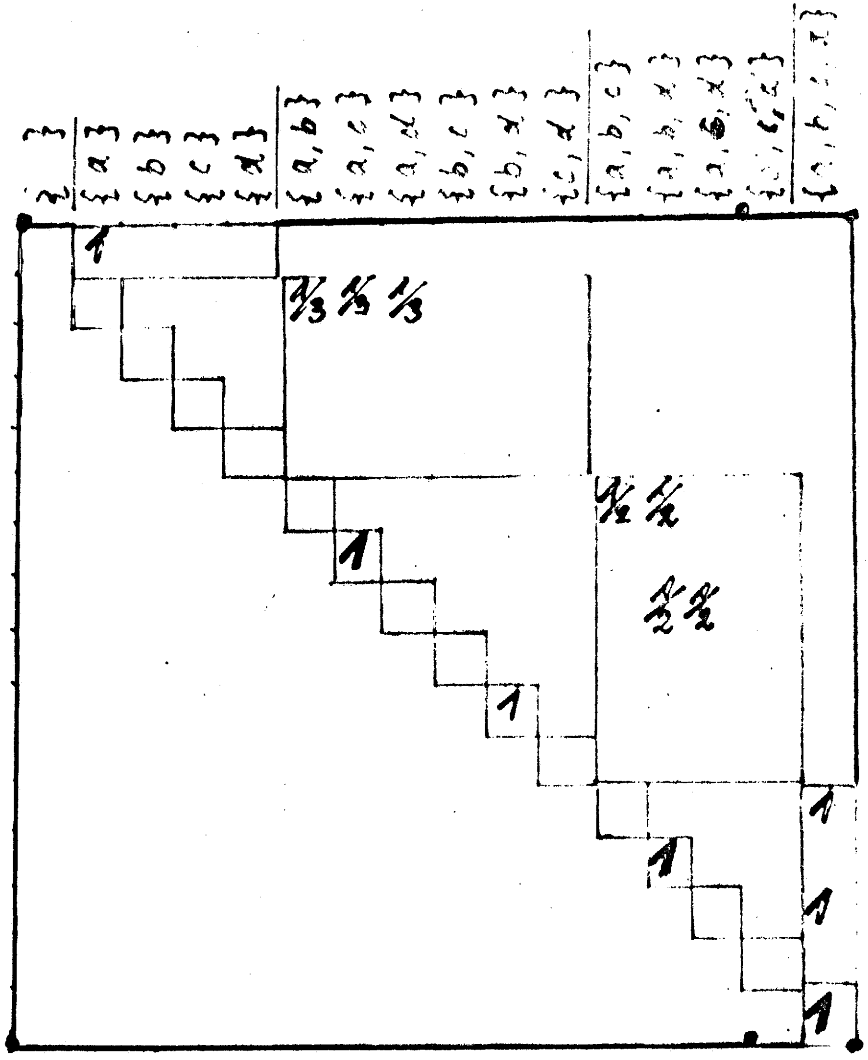

Fig.7 .