CHOICE AND SEGMENTED INTERREINFORCEMENT INTERVALS

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Pigeons were trained on a two-key concurrent schedule, where food reinforcers on one key were arranged by a simple variable-interval schedule and on the other key by a chain variable-interval variable-interval schedule. When the initial link of the chain was in effect, the pigeons tended to respond more on the simple variable-interval schedule, and hence less on the chain, than would be expected from a comparison of both the local and overall rates of reinforcement of the two schedules. When the terminal link of the chain was in effect, the pigeons responded more on the chain than would be expected from a comparison of the rates of reinforcement of the schedules then in effect. Overall responding on the chain was not proportional to overall reinforcement on the chain but rather was a by-product of responding during initial- and terminal-link phases.

Key words: choice, concurrent schedules, matching, chain schedules, key peck, pigeons

A common finding in choice experiments is that responding is distributed among concurrently available alternatives roughly in proportion to the reinforcers obtained from those alternatives (e.g., the matching law). Although many experiments have examined the distribution of choice responding as a function of the distribution of reinforcers on concurrent VI (variable-interval) schedules (for a review, see de Villiers, 1977), an issue of perhaps greater contemporary interest is what happens when other kinds of schedules are presented for choice. The present experiment attempted to engage this issue by examining pigeons' responding on a concurrent schedule in which one alternative was a simple VI schedule and the other, a chain VI VI. Of particular concern was the relationship between the proportion of reinforcers obtained on the chain and behavioral allocation to the chain. That is, should behavioral allocation to the chain be considered a function of the overall obtained interreinforcement interval (IRI) of the chain (Baum, 1973; Schneider, 1972), or should behavioral allocation to the initial and terminal

links be considered independently (Duncan & Fantino, 1972; Fantino & Duncan, 1972)? The answers to such questions will presumably facilitate a more general theoretical understanding of how an organism's responses are distributed among choice alternatives in an increasingly broad variety of experimental situations.

METHOD

Subjects

The subjects were six adult male pigeons (P-1, P-2, P-3, P-4, P-5, and P-6) of mixed breeds and various experimental histories. The pigeons were deprived to approximately 80% of their free-feeding weights and sessions were conducted after approximately 23 hours of food deprivation.

Apparatus

The apparatus was a two-key version of a standard experimental chamber for pigeons. Conventional electromechanical programming equipment, located in a room adjacent to the chambers, controlled events within the chambers and recorded the data.

Procedure

Sessions were conducted at approximately the same time of day, 6 days per week. Sessions were terminated after the pigeon had collected a predetermined number of reinforcers,

This research was partially supported by NIMH Grant MH 20752 to the University of California, San Diego. Reprints may be obtained from Jay Moore at the following address: Department of Psychology, University of Wisconsin-Milwaukee, Milwaukee, Wisconsin 53201. The author wishes to express his thanks to Tami Sellman and Denise Valenti for their expert assistance in conducting the experiment.

which was set to produce a session duration of approximately 1 hr. In conditions involving richer schedules, the number of reinforcers was set so that session duration was approximately 30 min, in order to prevent satiation. Reinforcement consisted of 3-sec access to mixed grain.

The pigeons were trained on a concurrent schedule. Responses on one key were reinforced according to a simple, independent VI schedule. Responses on the other key were reinforced according to a chain VI VI schedule. On this schedule, completion of the initial-link VI schedule produced a terminal-link VI schedule and associated stimulus; completion of the terminal-link VI schedule produced food. Following the reinforcement cycle, the initial-link schedule and stimulus were reinstated. For P-1 and P-2, the VI stimulus and the initial-link stimulus were both white; the terminal-link stimulus was red. For the other pigeons, the VI stimulus and the initial-link stimulus were both a horizontal line; the terminal-link stimulus was a vertical line. A changeover delay (COD) of 2 sec was in effect throughout. The COD remained in effect through transitions between links of the chain and through the reinforcement cycle. For a given set of schedule values (i.e., the IRIs of the initial and terminal links of the chain, and the IRI of the simple VI), there was first an initial determination of 15 sessions. Then a reversal was conducted, using the same schedule values, also for 15 sessions. In the reversal, the schedule formerly in effect on left key was now in effect on the right key, and vice versa. Schedule values were changed following a reversal. Three different VI schedules were employed: VI 120-sec, VI 240-sec, and VI 480-sec. A variety of chain schedules, defined by the IRIs of the initial and the terminal links, were pitted against each VI schedule. Time allocation and response distribution data, measured after the COD had been satisfied, were collected separately for the initial- and terminal-link phases of the procedure. Table 1 presents the details of the schedules to which the pigeons were exposed.

RESULTS

Table 2 presents time allocation, response distribution, and obtained reinforcement data for each pigeon in each determination of the

Table 1

The details of the schedules to which the pigeons were exposed are presented. Included are the pigeons, the VI schedule against which the designated chain schedules were pitted, and the scheduled relative rate of reinforcement (chain/chain + VI) for the chain's initial link, the chain's terminal link, and the chain overall.

Pigeon	VI Schedule vs. Chain Schedule	Scheduled Relative Rate of Reinforcement		
		Initial Link	Termi- nal Link	Overall
P-1, P-2	VI 120 vs.			
	chain VI 60 VI 60	.67	.67	.50
	chain VI 15 VI 60	.89	.67	.62
	chain VI 60 VI 15	.67	.89	.62
	chain VI 15 VI 15	.89	.89	.80
	VI 480 vs.			
	chain VI 240 VI 240	.67	.67	.50
	chain VI 60 VI 240	.89	.67	.62
	chain VI 240 VI 60	.67	.89	.62
	chain VI 60 VI 60	.89	.89	.80
	VI 240 vs.			
	chain VI 60 VI 60	.80	.80	.67
P-3, P-4	chain VI 30 VI 30	.89	.89	.80
	VI 120 vs.			
	chain VI 30 VI 30	.80	.80	.67
	VI 240 vs.			
P-5, P-6	chain VI 120 VI 60	.67	.80	.57
	chain VI 30 VI 60	.89	.80	.73
	chain VI 120 VI 30	.67	.89	.62
	chain VI 60 VI 30	.80	.89	.73

experiment. Figures 1 and 2 present relative rate measures (chain/chain + VI) of the time, response, and reinforcement data. The data are averages of the initial and reversal determinations of each chain against its corresponding VI schedule. The time and response measures are presented as histograms for the initial-link phase, the terminal-link phase, and overall; the horizontal dashed line in each panel of the figures is the obtained relative reinforcement rate on the chain (chain/chain + VI).

As may be seen in the table and figures, time allocation and response distribution measures were systematically less than relative reinforcement rate during the initial-link phase but systematically greater during the terminal-link phase. That is, among the 30 comparisons, only the initial-link behavior of P-2 from VI 480-sec vs. chain VI 60-sec VI 240-sec, as shown in Figure 1, approximated the reinforcement rate. For all other comparisons, the

Table 2

Time allocation and response distribution during each phase of each determination for each pigeon are presented. In addition, the number of food reinforcers earned on each key in each determination is presented. For P-3 and P-4 only, the number of reinforcers earned on the VI key during the initial and terminal link phases of the procedure is included in parentheses; the number from the initial-link phase appears first. All data are averages from the last 3 sessions of each 15-session condition. Experimental conditions were conducted in the order listed. All schedule values are in sec.

Pigeon	Condition	Initial Link Phase		Terminal Link Phase		Food Reinforcers
		Time	Resp	Time	Resp	
P-1	1A L VI 120	42.9	2203	1.0	59	26
	R Chain VI 60 VI 60	1.1	20	3.5	197	4
	1B L Chain VI 60 VI 60	1.0	20	2.7	307	9
	R VI 120	37.5	2874	1.4	150	21
	2A L VI 480	22.7	2082	3.5	287	8
	R Chain VI 240 VI 240	5.3	236	6.7	645	7
	2B L Chain VI 240 VI 240	1.6	110	5.3	655	7
	R VI 480	32.8	3919	3.6	368	8
	3A L Chain VI 15 VI 60	1.8	142	8.4	1053	29
	R VI 120	6.2	643	5.3	497	21
	3B L VI 120	6.1	547	5.0	573	21
	R Chain VI 15 VI 60	3.6	208	23.2	2273	29
	4A L Chain VI 60 VI 15	4.7	411	6.2	739	31
	R VI 120	25.5	1551	.4	24	29
	4B L VI 120	17.2	1205	.1	739	29
	R Chain VI 60 VI 15	10.9	762	6.7	624	31
	5A L Chain VI 15 VI 15	7.4	556	13.0	1326	81
	R VI 120	11.5	474	1.2	108	19
	5B L VI 120	8.3	299	.9	95	24
	R Chain VI 15 VI 15	10.6	603	15.5	1368	76
	6A L Chain VI 60 VI 60	6.8	445	18.1	2016	25
	R VI 480	13.1	989	1.7	151	5
	6B L VI 480	10.7	550	1.7	147	6
	R Chain VI 60 VI 60	9.7	636	17.2	2018	24
	7A L Chain VI 60 VI 240	3.5	91	18.9	1418	11
	R VI 480	7.4	626	11.3	734	9
	7B L VI 480	3.1	170	7.5	516	7
	R Chain VI 60 VI 240	7.2	456	24.1	2164	13
	8A L Chain VI 240 VI 60	6.7	519	6.7	593	12
	R VI 480	23.8	2356	.2	22	8
	8B L VI 480	19.8	1177	.8	62	8
	R Chain VI 240 VI 60	11.8	815	7.0	640	12
P-2	1A L VI 120	21.7	164	2.1	36	25
	R Chain 60 VI 60	6.2	22	3.8	41	5
	1B L Chain VI 60 VI 60	1.0	16	5.0	404	9
	R VI 120	22.6	1250	.6	29	21
	2A L VI 480	22.5	817	6.2	269	8
	R Chain VI 240 VI 240	8.3	449	13.5	1014	7
	2B L Chain VI 240 VI 240	1.6	28	12.7	797	7
	R VI 480	23.6	634	8.1	493	8
	3A L Chain VI 240 VI 60	29.0	2095	15.8	1495	13
	R VI 480	42.0	2078	0	0	7
	3B L VI 480	22.8	2316	.3	24	8
	R Chain VI 240 VI 60	15.7	903	10.4	1064	12
	4A L Chain VI 60 VI 240	7.1	819	27.9	2740	16
	R VI 480	1.8	156	6.2	619	4
	4B L VI 480	2.5	300	4.2	380	6
	R Chain VI 60 VI 240	6.8	400	27.5	1731	14
	5A L Chain VI 60 VI 60	16.0	1155	15.0	1504	24
	R VI 480	4.0	316	1.9	168	6
	5B L VI 480	12.4	845	1.1	123	6
	R Chain VI 60 VI 60	23.1	1012	12.0	1523	24

Table 2 continued

Pigeon	Condition		Initial Link Phase		Terminal Link Phase		Food Reinforcers
			Time	Resp	Time	Resp	
P-3	6A	L Chain VI 15 VI 15	11.1	738	13.4	1847	79
		R VI 120	4.9	351	1.8	146	21
	6B	L VI 120	8.3	593	.7	42	14
		R Chain VI 15 VI 15	13.2	722	16.2	1890	86
	7A	L Chain VI 15 VI 60	5.5	423	16.9	2076	32
		R VI 120	3.6	286	6.2	468	18
	7B	L VI 120	8.3	555	8.7	648	21
		R Chain VI 15 VI 60	4.6	121	13.4	1027	29
	8A	L Chain VI 60 VI 15	17.0	1482	7.5	991	28
		R VI 120	19.3	1185	.3	21	22
	8B	L VI 120	11.1	404	.4	32	19
		R Chain VI 60 VI 15	16.7	221	4.3	485	31
	1A	L VI 240	7.2	289	.4	21	9 (7,2)
		R Chain VI 30 VI 30	9.0	577	17.7	1701	41
	1B	L Chain VI 30 VI 30	.7	43	17.4	1286	41
		R VI 240	3.5	186	1.8	143	9 (6,3)
	2A	L VI 240	20.5	840	.5	43	12 (8,4)
		R Chain VI 60 VI 60	10.7	441	27.2	2026	28
	2B	L Chain VI 60 VI 60	4.1	263	19.6	945	27
		R VI 240	27.2	1451	6.9	364	13 (8,5)
	3A	L VI 120	11.0	456	.9	53	16 (11,5)
		R Chain VI 30 VI 30	3.0	200	14.0	1644	34
	3B	L Chain VI 30 VI 30	3.7	115	12.8	1051	31
		R VI 120	17.7	1586	.3	23	19 (17,2)
P-4	1A	L VI 240	16.5	892	.1	5	11 (11,0)
		R Chain VI 30 VI 30	5.2	301	19.3	1434	39
	1B	L Chain VI 30 VI 30	.8	42	18.9	1447	42
		R VI 240	9.3	317	.1	3	8 (8,0)
	2A	L VI 240	15.5	578	.7	30	9 (8,1)
		R Chain VI 60 VI 160	7.5	311	20.8	1354	26
	2B	L Chain VI 60 VI 60	2.1	100	17.8	1203	21
		R VI 240	28.2	1639	4.5	241	14 (10,4)
	3A	L VI 120	20.0	1914	.3	6	20 (20,0)
		R Chain VI 30 VI 30	1.4	193	11.2	821	30
	3B	L Chain VI 30 VI 30	3.0	206	12.7	1622	32
		R VI 120	13.4	1346	0	0	18 (18,0)
P-5	1A	L Chain VI 60 VI 30	12.2	254	9.8	1061	22
		R VI 240	10.7	267	1.5	44	8
	1B	L VI 240	5.6	730	.6	61	7
		R Chain VI 60 VI 30	12.0	722	10.1	982	23
	2A	L Chain VI 120 VI 60	3.9	310	11.7	1867	16
		R VI 240	24.1	1716	4.0	318	14
	2B	L VI 240	25.1	1239	.8	57	14
		R Chain VI 120 VI 60	9.0	636	16.6	1561	16
	3A	L Chain VI 30 VI 60	4.2	216	14.5	1386	22
		R VI 240	6.7	363	2.1	177	8
	3B	L VI 240	4.0	232	4.2	439	7
		R Chain VI 30 VI 60	5.0	318	11.2	1116	23
P-6	4A	L Chain VI 120 VI 30	7.1	297	7.9	893	13
		R VI 240	14.9	909	0	0	7
	4B	L VI 240	14.9	745	.4	20	7
		R Chain VI 120 VI 30	6.9	438	6.6	673	13
	1A	L Chain VI 60 VI 30	13.7	509	7.6	889	20
		R VI 240	7.1	176	1.3	72	10
	1B	L VI 240	9.3	549	0	0	8
		R Chain VI 60 VI 30	12.5	1070	11.4	718	22
	2A	L Chain VI 120 VI 60	6.4	325	12.2	1803	15
		R VI 240	40.5	2237	1.6	124	15
	2B	L VI 240	49.4	4849	.2	18	10
		R Chain VI 120 VI 60	8.9	613	23.0	2135	20

Table 2 continued

Pigeon	Condition	Initial Link Phase		Terminal Link Phase		Food Reinforcers
		Time	Resp	Time	Resp	
3A	L Chain VI 30 VI 60	5.7	308	17.9	1529	23
	R VI 240	7.3	568	3.4	206	7
3B	L VI 240	12.2	574	.2	3	6
	R Chain VI 30 VI 60	6.8	326	23.0	2653	24
4A	L VI 240	31.2	1232	.6	26	7
	R Chain VI 120 VI 30	6.9	312	6.0	684	13
4B	L Chain VI 120 VI 30	9.3	782	7.3	920	13
	R VI 240	18.4	1208	0	0	7

Fig. 1. Behavioral allocation (time in unfilled bars, responses in filled bars) is presented for each chain VI VI against its corresponding VI schedule for P-1 and P-2. The measures are relative rate measures (chain/chain + VI) and are plotted separately for the initial-link phase, terminal-link phase, and overall. Also presented as a horizontal dashed line in each panel is the obtained overall relative rate of food reinforcement on the chain. All schedule values are in sec. The data are averages of the entries from Table 2.

Fig. 2. Behavioral allocation (time in unfilled bars, responses in filled bars) is presented for each chain VI VI against its corresponding VI schedule for P-3, P-4, P-5, and P-6. The measures are relative rate measures (chain/chain + VI) and are plotted separately for the initial-link phase, terminal-link phase, and overall. Also presented as a horizontal dashed line in each panel is the obtained overall relative rate of food reinforcement on the chain. All schedule values are in sec. The data are averages of the entries from Table 2.

proportion of initial-link behavior allocated to the chain was lower than the relative reinforcement rate. However, in every case the proportion of terminal-link behavior allocated

to the chain was greater than the relative reinforcement rate. In fact, Table 2 shows certain determinations where there was virtually exclusive preference for the terminal-link VI

schedule over the simple VI schedule concurrently available on the other key.

Note that the overall time allocation and response distribution measures were not the simple averages of the measures during the initial- and terminal-link phases, but rather reflect the measures weighted with respect to the proportion of the session actually spent in initial- and terminal-link phases. Among the 30 comparisons, there were 26 when overall time allocation, and 17 when overall response distribution, were less than relative reinforcement rate. Thus, the overall measures are perhaps best interpreted as by-products of the measures from the initial- and terminal-link phases. Note also that the measures cannot be products of simple bias, since the data in the figures are averages of initial and reversal determinations. The reversal procedure removes any contamination arising from bias.

Several other features of the pigeons' behavior may be seen in the figures. For example, for chains with a given terminal link, a greater proportion of initial-link behavior was allocated to the chain when there was a short initial link than when there was a long initial link (e.g., when VI 120-sec was pitted first against chain VI 60-sec VI 15-sec and then against chain VI 15-sec VI 15-sec). In addition, comparisons between pigeons for a given chain (e.g., chain VI 60-sec VI 60-sec) reveal that as the IRI of the VI schedule concurrently available on the other key increased (e.g., from VI 120-sec to VI 240-sec to VI 480-sec), there was a general increase in the proportion of initial-link behavior allocated to the chain. Comparisons within Pigeons P-3 and P-4 for chain VI 30-sec VI 30-sec vs. VI 120-sec and VI 240-sec reveal a comparable increase.

The present data do not unequivocally indicate whether manipulation of the initial- or terminal-link schedule of the chain exerted the greater effect on initial-link behavior. For example, when VI 120-sec was pitted against chain VI 60-sec VI 60-sec, and then the chain was reduced to chain VI 15-sec VI 60-sec in one case and to chain VI 60-sec VI 15-sec in another, there was approximately the same increase in initial-link behavior in each case. On the other hand, when comparable manipulations were performed with chains pitted against the VI 480-sec schedule, chain VI 60-sec VI 240-sec seemed to control more behavior than did chain VI 240-sec VI 60-sec. The

present findings may be compared with Fantino's (1969) finding of preference in a concurrent chains procedure for chain VI 90-sec VI 30-sec over chain VI 30-sec VI 90-sec, presumably indicating that a long initial link and short terminal link control more behavior than the reverse order of the schedules (see Moore, 1976, for further discussion of this issue as related to percentage of reinforcement in chain schedules).

Recall that during the terminal-link phase of the procedure, the terminal-link VI schedule was in effect on one key, and a simple VI was in effect on the other. Thus, in principle, the terminal-link phase was equivalent to the conventional concurrent VI VI schedule, where each of two concurrently available VI schedules offers food reinforcers directly. However, the data reveal that the pigeons responded far from conventionally in this phase of the procedure. Instead of responding in proportion to the local (scheduled) relative rate of reinforcement, the pigeons tended to respond greater than proportionally to the terminal-link VI schedule of the chain (see also Baum, 1974). This pattern is evident in virtually every panel of the figures. Note especially VI 240-sec vs. chain VI 120-sec VI 60-sec, where P-5 allocated nearly .90 and P-6 allocated over .90 of their terminal-link behavior to the chain, even though reinforcers were scheduled on only a 4:1 basis (i.e., concurrent VI 60-sec VI 240-sec).

Data on whether the VI reinforcers were obtained during the initial- or terminal-link phases of the procedure were collected for P-3 and P-4 only. These data are included in Table 2. Of particular interest are the numbers of VI reinforcers during the terminal-link phases. For P-3, the behavior allocated to the chain is more extreme than the resulting reinforcement distribution in four instances of the six and less in two. For P-4, the behavioral allocation approximates the reinforcement distribution in all six instances, although in four of the six instances there were no reinforcers gained on the VI schedule during the terminal-link phase because of the nearly exclusive responding on the terminal link of the chain.

DISCUSSION

The major finding of the present experiment was that when the initial link of a chain

VI VI schedule was in effect on one key and a simple VI on the other, the pigeons preferred the simple VI schedule, but when the terminal link of the chain VI VI was in effect, the pigeons preferred the chain. Thus, the chain was not treated as an integrated IRI, based on the sum of the initial- and terminal-link schedules; rather, responding on the chain was differentiated in terms of the prevailing component (cf., Duncan & Fantino, 1972; Schneider, 1972).

The preference for the VI during the initial-link phase of the procedure is reminiscent of an effect reported by Fantino and Duncan (1972), who, in the course of exploring the effects of varying the typical sequence of events in the concurrent chains procedure, suspended the provision for mutually exclusive terminal-link schedules. Thus, when the pigeons entered one terminal link during their experiment, the other (initial-link) schedule remained operative, i.e., the other key remained illuminated and its associated VI timer continued to operate. Fantino and Duncan (1972) noted that when an initial link was pitted against a terminal link, the pigeons virtually ignored the initial-link key, although the pigeons generally did make the first response after a reinforcer on the key that remained operative. The schedule that had remained operative, of course, was a chain VI VI schedule, whereas the newly produced terminal-link schedule was a VI schedule that provided food reinforcers directly, as in the present procedure. Thus, the present experiment confirms and extends the earlier report of Fantino and Duncan (1972) and suggests that the effect holds over a wide range of schedule values.

The extreme preference for the chain during the terminal link phases of the procedure was unanticipated, and it is instructive to examine this effect from the perspective of behavioral contrast. Wilton and Gay (1969) have noted that contrast does occur in the terminal link of chain schedules, in that absolute response rates maintained by a given VI schedule were greater when that schedule was arranged as the terminal link of a chain than when it was arranged in isolation. Moreover, Taus and Hearst (1970) have shown that absolute response rate during the VI component of a multiple VI EXT schedule increased as the duration of the EXT component increased. These findings accord well with the

data in Table 2, showing that the absolute response rates maintained by a given terminal link VI schedule were greater when it was preceded by a longer VI schedule. Thus, the data from the terminal-link phase of the present procedure appear to be consistent with previous data in suggesting a contrast effect. However, the relative response rate in the terminal-link phase is also higher than is ordinarily expected. Whether this effect constitutes another aspect of contrast is at present somewhat unclear. Catania (1961, 1962) and Pliskoff, Shull, and Gollub (1968) all arranged a multiple VI VI or multiple VI EXT on one key, with a VI schedule concurrently available on the other. They noted a contrast effect in terms of the absolute response rates on the multiple key but did not find any concomitant distortion of the relative response rates. At present it is unclear why there should be a distortion of relative response rate in the present procedure but not in other procedures, given that there is contrast in terms of absolute response rates in each case.

The results of the present experiment may also be interpreted in the context of the matching law. Recall that according to the matching law, responses are distributed among concurrently available alternatives in proportion to the reinforcers obtained from those alternatives. Figures 1 and 2 show that behavioral allocation to the chain is not proportional to the obtained relative reinforcement rate, when considered overall. Is such an outcome consistent with the matching law? Actually, it is somewhat difficult to establish how the matching law interprets chain schedules. On the one hand, it has been argued (e.g., Baum, 1973, p. 144) that the overall obtained IRI of a schedule—even a chain schedule—is the important variable, and choice responding should be apportioned accordingly when chain schedules are involved.

On the other hand, it has also been argued that "instrumental behavior can be viewed as moving the organism through chains of situations" (Baum, 1973, p. 151). Within each situation, the organism's behavior is presumably distributed in proportion to the reinforcers obtained therein. Thus, the initial-link phase of the present procedure may be interpreted as constituting one situation, wherein responding on the VI key produces food reinforcers directly and responding on the chain

key produces a new situation, in which the terminal-link stimulus signals that reinforcement is now close in time. The terminal-link phase (situation) may then be interpreted as constituting another situation, in which responding on either key produces food reinforcers directly. When behavioral situations are so interpreted, the fact that during the initial-link phase the pigeons responded less on the chain key might not be so surprising: the reinforcer for such responding is only a change in a colored light, compared to the production of food on the VI key.

Although the present data suggest the latter line of reasoning to be more accurate than the former, the reader will undoubtedly recognize that neither the matching law nor the underlying molar conception of behavior upon which the matching law is based specifies when stimuli may be expected to assume a discriminative function by defining situations that affect rate of responding, over and against the influence of the obtained reinforcement rate. Moreover, when the line of reasoning is carried further, stimuli other than keylights should also be able to define situations. Thus, temporal factors may well serve to define situations, and if situations may vary as a function of the passage of time, as presumably they may, then the organism may come to respond on the basis of moment-by-moment changes in reinforcer availability. Thus, unless the molar position is specified in terms only of the influence of the obtained overall rate of reinforcement, the molar position loses its identifying properties and ironically reduces to a molecular position, for which it is trying to be the alternative.

Moreover, recall that during the terminal-link phase of the procedure, responding on either key produced food reinforcers directly, yet the pigeons responded primarily, and in some cases exclusively, on the chain key. Can these findings be accommodated by the matching law? In one sense, only the data from P-3 and P-4 apply, because only for these pigeons was the number of VI reinforcers gained during the terminal-link phase recorded independently. It might be argued that these data cannot be taken as evidence against the matching law, because there is no major discrepancy between obtained relative reinforcement and behavioral allocation. Indeed, it is nearly perfect matching if the pigeon responds nearly exclu-

sively on the terminal-link key and obtains nearly all its reinforcers from that one source. The utility of such data to support matching seems questionable.

Does the foregoing imply that the results of the present experiment should be taken as validation of the generality of the matching law and the underlying molar conception of behavior (cf., Moore, 1979)? It should be pointed out that although the matching law asserts a proportionality between behavioral allocation and obtained reinforcement, it does not specify the relation between obtained and scheduled rate of reinforcement. Thus, at face value, the matching law does not mediate prediction, even in principle, of behavioral allocation in any situation. It simply attempts to describe that allocation after the fact. If the aim of science is to predict and control, then surely the matching law is a unique product of a scientific undertaking. In the current case, the matching law does not specify in an a priori sense that such a great proportion of behavior should be allocated first to the VI during the initial-link phase, then to the chain during the terminal-link phase. Thus, the present finding may be added to others that challenge the matching law, not so much because the matching law does not account post hoc for an adequate percentage of the variance (although it may not; e.g., Moore, 1976, 1979), but rather because the molar conception of behavior upon which it is predicated seems to be inadequate. The current data suggest a far more complex interaction among variables, taking place in a far different time frame, than one might expect on the basis of the molar approach, and it appears wise not to overestimate the state of our knowledge.

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Received July 23, 1981

Final acceptance May 7, 1982