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EFFECTS OF EXPERIENCE ON PREFERENCE BETWEEN FORCED AND FREE CHOICE

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Preference between forced choice and free choice in concurrent-chain schedules of reinforcement was investigated in pigeons after exposure to particular combinations of terminal links. In Experiment 1, in which terminal links always ended with reinforcers, one of three pairs of terminal links was arranged as preexposure: (a) both terminal links had only one key (forced choice), (b) both terminal links had two keys (free choice), or (c) a combination of forced and free choice was arranged across sessions. In test sessions following the preexposure, pigeons' preferences rapidly shifted to the terminal links with which they had no recent experience. In Experiment 2, the same procedure was repeated except that each terminal link ended intermittently with reinforcers with a probability of .5 and there was no terminal-link arrangement with a combination of free and forced choice. Pigeons showed the same preference changes as in Experiment 1, but the preference changes did not appear immediately at the beginning of test sessions. These data suggest that recent previous experience was a more important determinant of preference than the difference between forced-choice and free-choice terminal links.

Key words: choice behavior, experience, behavioral history, preference, forced versus free choice, multiple concurrent-chain schedule, key peck, pigeons

Choice behavior is one of the most common features of the behavior of an organism, and therefore within experimental and applied behavior analysis considerable research has been conducted in this area. The variables that determine preferences in choice behavior include the contingencies that are current as the organism behaves, ontogenetic factors derived from the contingencies that have previously acted on the organism's behavior, and phylogenetic factors derived from evolutionary contingencies that have acted on the organism's species.

Of these variables, the current contingency is often most critical. Many studies on choice behavior using concurrent schedules or concurrent-chain schedules of reinforcement have examined the effects of current contingencies (Autor, 1969; Baum, 1979; Fantino, 1969; Grace, 1994; Herrnstein, 1961). These studies have developed quantitative analyses for choice behavior and successfully demonstrated how amount, delay, and probability of reinforcement in current contingencies affect preference. Less experimental attention has been paid to the other two variables as determinants of preference, although some authors have suggested the possible contribution of ontogenetic factors (e.g., Catania, 1975; Freeman & Lattal, 1992; Okouchi, 2003; Ono & Iwabuchi, 1997; Wanchisen, Sutphin, Balogh, & Tatham, 1998) and of phylogenetic factors (e.g., Catania, 1975; Catania & Sagvolden, 1980; Hayes, Kapust, Leonard, & Rosenfarb, 1981).

The present study asks how the ontogenetic factor, past experience, affects choice behavior. In order to examine one effect of past experience experimentally, this study focused on preference for free versus forced choice in the terminal links of concurrent-chain schedules (Catania, 1975).

In concurrent-chain schedules of reinforcement with pigeons, the organism typically is presented in the initial links with two keys, each of which is associated with a variable-interval (VI) schedule. Meeting the schedule requirement on either key produces the terminal-link schedule correlated with that key. Preference between forced choice and free choice is assessed using two different terminal links. In the forced-choice alternative, only one lit key is available and pecks on that key produce fixed-interval (FI) reinforcement. In the free-choice alternative, two lit keys are available and pecks on either of the

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keys produce FI reinforcement. In such procedures, preference between free and forced choice is measured by the relative response rate in the initial links.

Preference for free choice over forced choice in pigeons has been demonstrated in concurrent-chain schedules of reinforcement (Catania, 1975; Catania & Sagvolden, 1980; Cerutti & Catania, 1997) and in multiple concurrent-chain schedules of reinforcement (Cerutti & Catania, 1986). Preference for free choice over forced choice has also been demonstrated in rats (Voss & Homzie, 1970), monkeys (Suzuki, 1999), and humans (Suzuki, 1997, 2000). In these studies, the availability of alternatives in one terminal link, which can vary in number of choices, stimulus variety, and information value of the stimuli, distinguishes free choice from forced choice.

Preference for free choice, however, may be affected by other variables and by the detailed contingencies operating in different procedures (Hayes, Kapust, Leonald, & Rosenfarb, 1981; Leigland, 1979; Suzuki, 1997, 1999). For example, Hayes et al. examined pigeons' preference between two-alternative (A and B) and one-alternative (B alone) terminal links in discrete-trial concurrent-chain procedures. They found that if the probability of choosing A or B given the choice between A and B is about equal, pigeons will prefer the choice of both A and B over B alone; but if the probability of selecting A given the choice between A and B is nearly zero, then pigeons will prefer B alone over the choice of both A and B. Suzuki (1999), however, reported that monkeys in similar procedures preferred two-alternative terminal links even when the reinforcement probability of one of the two alternatives was lower than the probability of the other alternative. Although Experiment II of Catania (1975) also showed a small preference for two terminal-link alternatives over one alternative in a similar procedure, the difference in detailed arrangements for key colors, initial-link contingencies, and reinforcer scheduling makes comparison difficult.

Thus, except for some special cases, the preference of organisms for free choice over forced choice seems to be consistent across most experiments. However, although all these experiments investigated the effects of current contingencies, possible effects of past experience on the preference between forced choice and free choice have not been considered.

Some evidence suggests that preference may be affected by past experience. Ono (2000), for example, investigated pigeons' preferences for free choice over forced choice under probabilistic contingencies compared with preference under nonprobabilistic contingencies in multiple concurrent-chain schedules of reinforcement. When naive pigeons were first exposed to probabilistic contingencies, a distinct preference for two lit keys over one lit key in the terminal links was observed, but no consistent preference was observed when exposure to probabilistic contingencies followed exposure to nonprobabilistic contingencies. Because preference for free choice under the nonprobabilistic contingencies was very small and inconsistent, Ono (2000) suggested that any history or carryover effects of the prior contingencies might lessen the sensitivity of the pigeon's behavior to the probabilistic contingencies.

Effects of past experience in choice also have been studied by Devenport and Devenport (1993, 1994). They examined how past experiences combine to affect current choice in foraging situations for different species and suggested that the influence of past experience on an organism's current choice behavior may be an inverse function of its recency. Mazur (1996) and Mazur, Blake, and McManus (2001) also examined choice during periods of transition from one session to another session. In an analysis of spontaneous recovery, Mazur argued that choice behavior at the start of a new session reflects some weighted average of the events of the past several sessions.

The present study examined the effects of prior experience on preference between forced choice and free choice in two experiments. In Experiment 1, before testing for free- versus forced-choice preference, pigeons were exposed to one of three different contingencies as prior experience: forced choice only, free choice only, and both forced choice and free choice, each with delivery of food reinforcers at the end of every terminal link. Because Ono (2000) suggested that preference may be affected by the probability of food delivery at the end of terminal links, Ex-

periment 2 examined the effects of either of two prior experiences: forced choice only and free choice only, each with a probability of .5 of food delivery at the end of each terminal link.

EXPERIMENT 1

Effects of three histories on preference between forced choice and free choice were compared when food was delivered with probability of 1.0 at the end of every terminal link. The three prior experiences were forced choice only, free choice only, and both forced choice and free choice.

METHOD

Subjects

The subjects were 3 homing pigeons that had previously served in an experiment on choice with similar procedures and in another experiment on differential training of high and low rates of responding. They were individually housed in a facility with a 12:12 hr light/dark cycle and maintained at approximately 80% of their free-feeding weights.

Apparatus

A modified Gerbrands three-key chamber (Gerbrands test chamber G7463) was enclosed in a sound-attenuating enclosure containing an exhaust fan for ventilation and for masking extraneous noise. The two side keys could be lit blue, white, or green and the center key could be lit green. Pecks on a lit key with a minimum force of about 0.15 N operated the key. Dark-key pecks had no scheduled consequences. A houselight was mounted on the ceiling. Reinforcement consisted of 4-s presentation of hemp seeds by a feeder located just off the floor below the center key. During reinforcement, the feeder light was lit and all other lights (i.e., key lights and houselight) were off. Scheduling and recording were arranged by electromechanical equipment in an adjoining room.

Procedure

The experiment consisted of three phases. First, a baseline phase to measure baseline preference between free- and forced-choice terminal links; second, an experience phase in which particular terminal links were arranged as history; and third, a test phase in which preference between free choice and forced choice was again measured.

Baseline phase. A multiple concurrent-chain schedule of reinforcement was used to measure preference in the baseline and all other phases. In this procedure, preference between one-alternative and two-alternative terminal-link schedules was measured with the probability of reinforcement set at 1.0 at the end of each terminal link and with the same green stimuli for all key lights in each terminal link. In the multiple concurrent-chain schedules, blue initial-link keys signaled one left/right arrangement of the terminal links, whereas white initial-link keys signaled the left/right reversal of the terminal links. The initial links changed randomly with a probability of .5 after every 2 min spent in the initial links. When components changed, any terminal-link entry that had been arranged, but not taken, was canceled. Initial links were arranged on the two side keys; the center key was dark.

The multiple concurrent-chain schedules will be described using the blue component as an example. In the initial links, equal independent VI 15-s schedules were arranged concurrently throughout both experiments. A changeover delay of 2 s operated for initial-link responding: A peck that occurred within 2 s of a changeover from one initial-link key to the other could not produce a terminal link. Initial-link timing was suspended during terminal links. The houselight was off during initial and terminal links and was lit during a 2-s timeout that followed each terminal link. Sessions for all phases ended at termination of the first terminal link after 30 min of initial-link duration.

In the blue component, a response on the left key in the initial links produced a free-choice terminal link on the two leftmost keys, which were lit green. The same FI 10-s schedule operated for both keys. After the start of the terminal link, the first peck on either key turned off the keylight on the other key. When a response on the remaining green key met the FI requirement, the feeder operated for 4 s. Initial-link responses on the right blue key occasionally produced a forced-choice terminal link on only the rightmost key, which was lit green. An FI 10-s schedule op-

erated for this key that terminated in 4-s reinforcement.

With white keylights on the initial-link keys, terminal-link contingencies were reversed: Left-key pecks produced forced-choice terminal links (single leftmost green key) and right-key pecks produced free-choice terminal links (two rightmost green keys). Baseline sessions were conducted until 20 sessions of data had been collected.

Experience phase. In this phase, each pigeon was assigned to one of three choice contingencies that differed in the arrangement of the terminal links. For Pigeon 13, both initial links always produced forced-choice terminal links. For Pigeon 14, both initial links always produced a free-choice terminal link. For Pigeon 9, these two conditions alternated every other session giving the pigeon experience of both forced and free choice. This phase lasted until 50 sessions of data had been collected for all pigeons.

Test phase. In the test phase that followed the experience phase, pigeons' preferences between forced- and free-choice terminal links were measured. The multiple concurrent-chain schedules were arranged exactly the same as during the baseline phase. The phase ended when 30 sessions of data had been obtained.

Results and Discussion

Preference in multiple concurrent-chain schedules can be represented as a divergence from halfway between the relative left-key response rate (L/L+R) in the initial links in the blue component and the same relative rate in the white component (Cerutti & Catania, 1986). This preference measure can range from +.5 to −.5. If a pigeon prefers the free-choice terminal link (left during blue and right during white), then this measure will be positive; but if the pigeon prefers the forced-choice terminal link, then the measure will be negative (for further details, see Ono, 2000).

Figure 1 shows the results from the 3 pigeons assigned to three different experience conditions. The dashed vertical lines separate the baseline, experience, and test phases. In the baseline and test phases, positive values of this measure indicate preference for free choice over forced choice.

The left panel in each row of Figure 1 represents the data obtained in baseline sessions for each pigeon. Mean preferences during the baseline phase were 0.017 for Pigeon 13, 0.034 for Pigeon 14, and 0.018 for Pigeon 9. Preferences were consistent: For the 3 pigeons, respectively, 15, 18, and 14 of the 20 data points fell above zero, indicating a small preference for the free-choice terminal links.

Data from the experience phase (middle panel) showed values similar to baseline. Mean preference ratios of the experience phase were 0.015 for Pigeon 13, 0.009 for Pigeon 14, and 0.017 for Pigeon 9. For the 3 pigeons, respectively, 37, 28, and 43 of the 50 data points fell above zero.

The results of the test phase in the right panel showed different preference effects for each of the 3 pigeons. On the one hand, Pigeon 13, that was exposed to forced choice in the experience phase, clearly showed preference for free choice early in the test phase (all data points were above zero for the first 20 sessions), whereas Pigeon 14, that was exposed to free choice in the experience phase, clearly showed preference for forced choice (all data points were below zero for the first 20 sessions). Preferences for these 2 pigeons, however, shifted toward indifference later during the phase. On the other hand, Pigeon 9, that was exposed both to forced and free choice, showed no clear change in preference compared to its performance in the first test phase, with 15 of the 20 data points above zero.

Thus, in summary, although only 1 subject was assigned to each condition, the findings for the 3 pigeons were completely consistent with transient preference for the terminal-link contingency that had not been presented during the prior experience phase.

EXPERIMENT 2

Experiment 2 tested the effects of experiences on preference between forced and free choice when reinforcers were intermittently delivered at the end of terminal links. Two pigeons were assigned to forced-choice experience and the other 2 to free-choice experience. No pigeon was assigned to experience both forced choice and free choice.

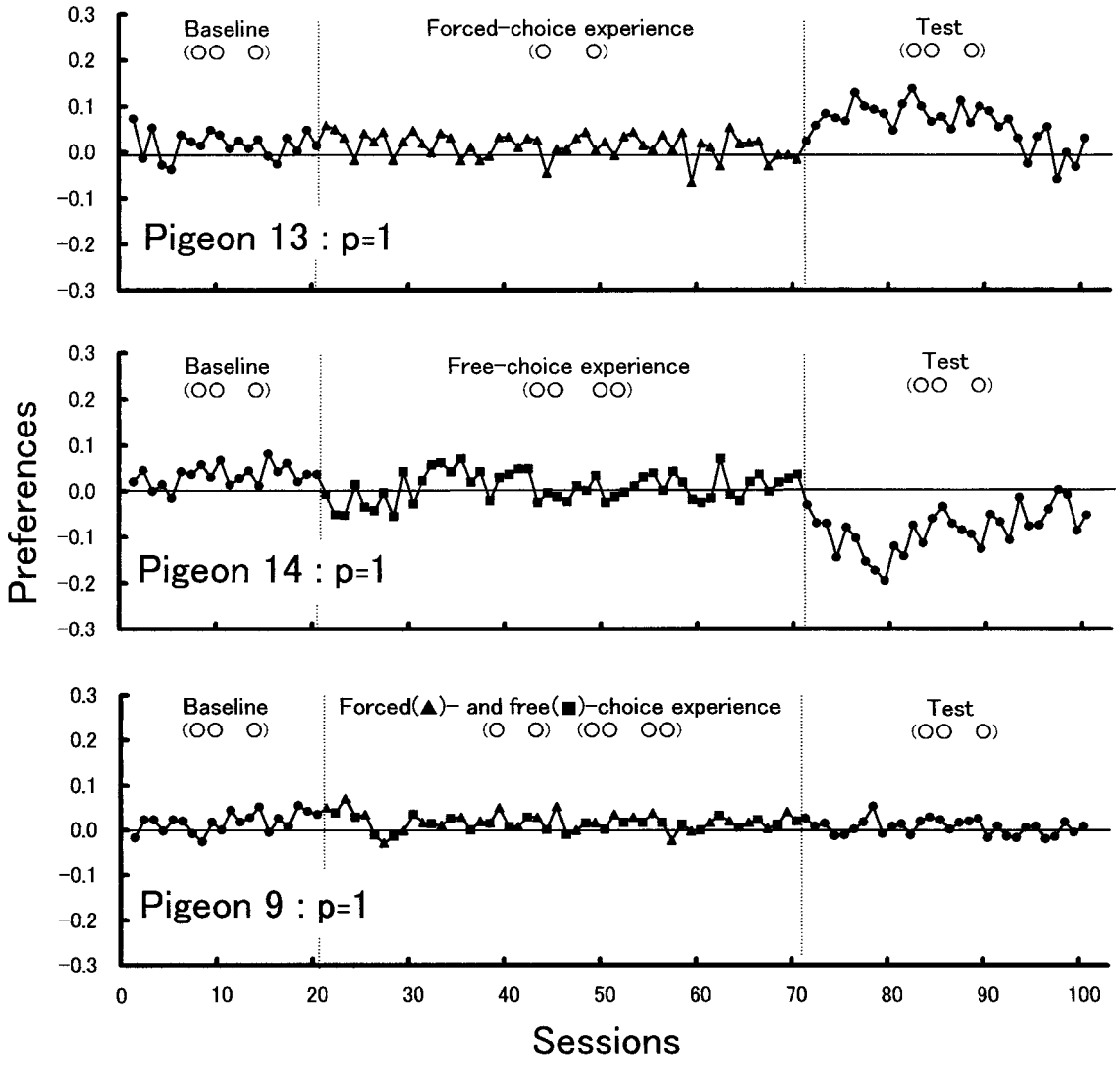

Fig. 1. Preference in baseline, experience, and test phases for the 3 pigeons for the three experience conditions in Experiment 1, in which probability of food delivery at the end of the terminal links was 1.0. If a pigeon prefers left (two green keys) during blue and right during white, preference will be positive, and vice versa. The dashed vertical lines divide the phases. The circles under the phase names represent the choice conditions presented in the terminal links (i.e., the double circle represents a free choice and a single circle represents a forced choice).

METHOD

Subjects

Four homing pigeons served as subjects. Two, Pigeons 13 and 14, had served in Experiment 1. The other 2 had experience in another choice experiment with multiple concurrent-chain schedules of reinforcement. Experiment 2 commenced 1 year after the end of Experiment 1.

Apparatus

The apparatus was the same as in Experiment 1.

Procedure

The procedure was the same as in Experiment 1 except as follows: (a) The probability of food at the end of each terminal link was .5, and (b) only two terminal-link contingencies, forced choice and free choice, were ar-

ranged as past experience in Experiment 2. As in Experiment 1, the experiment consisted of a baseline phase, an experience phase, and a test phase.

Baseline phase. The same multiple concurrent-chain schedules of reinforcement as Experiment 1 were used in both the baseline and test phases of Experiment 2. In Experiment 2, however, preferences between two terminal-link alternatives and one terminal-link alternative were examined with a reinforcement probability of .5 at the end of each terminal link.

Food delivery with a probability .5 in each terminal link was arranged as follows (for more detail, see Ono, 2000). In the initial links, equal and independent VI 15-s schedules were arranged concurrently. A response on the left blue key in the initial links produced a free-choice terminal link—the two leftmost keys were initially lit green and the same mixed FI 10-s extinction (EXT) schedule operated for both keys. The first peck on either key turned off the light on the other key. If the key that remained lit was the FI key, a peck on that key operated the feeder at the end of the interval; and if it was not the FI key, the key light turned off without a feeder operation at the end of the interval. The location of the FI components was arranged randomly with a probability of .5. In forced-choice terminal links, only one key was lit green, and it alternated randomly between FI 10 s and EXT with a probability of .5. After 10 s, either a peck operated the feeder if the schedule was FI, or the key light turned off without a feeder operation if it was EXT. With white lights on the initial-link keys, terminal-link contingencies were reversed between the left and right keys: Left-key pecks produced forced-choice terminal links (single leftmost key, lit green) and right-key pecks produced free-choice terminal links (two rightmost keys, both lit green). Duration of the feeder operation was 4 s for Pigeons 9, 10, and 13 and 5 s for Pigeon 14. The number of baseline sessions was 20 for Pigeons 10 and 14 and 21 for Pigeons 9 and 13.

Experience phase. In this phase, two types of terminal links were provided as experience. Pigeons 10 and 14 were assigned to the forced-choice condition; that is, each pigeon had only one key in a terminal link whichever initial link the pigeon pecked to produce the terminal link. For Pigeons 9 and 13, both initial links always produced free-choice terminal links; that is, the pigeon had two keys in a terminal link whichever initial link the pigeon pecked to produce the terminal link. The number of sessions was 40 for Pigeon 10, 41 for Pigeons 14 and 13, and 42 for Pigeon 9.

Test phase. The test phase was the same as the baseline phase. This test phase was shorter than Experiment 1 because of a temporary closure of the laboratory. The number of the sessions was 26 for Pigeon 10, 24 for Pigeons 14 and 9, and 23 for Pigeon 13.

Results and Discussion

Figure 2 shows the results from the 4 pigeons. The upper two graphs show data from the 2 pigeons assigned to forced-choice experience, and the lower two graphs show data from the 2 pigeons assigned to free-choice experience.

Data from the baseline sessions in the left panel of Figure 2 show consistent preference for the free-choice alternatives for all pigeons except Pigeon 10, which showed a small forced-choice preference. Mean preference measures for the baseline phase were −0.018 for Pigeon 10, 0.017 for Pigeon 14, 0.040 for Pigeon 9, and 0.034 for Pigeon 13. The number of data points above zero for each of these subjects was, respectively, 5 of 20, 16 of 20, 20 of 21, and 19 of 21 total data points.

In the experience phase shown in the middle panel, all 4 pigeons continued to show preferences similar to those in the baseline phase. Mean preference ratios for the experience phase were −0.029 for Pigeon 10, 0.004 for Pigeon 14, 0.049 for Pigeon 9, and 0.039 for Pigeon 13. The number of data points above zero was, respectively, 1 of 40, 23 of 41, 42 of 42, and 38 of 41 total data points.

In the test phases (right panel), all 4 pigeons showed marked changes in preference. Pigeons 10 and 14, which were exposed to forced-choice terminal links in the experience phase, clearly showed preferences for free choice, whereas Pigeons 9 and 13, that were exposed to free-choice terminal links in the experience phase, clearly showed preferences for forced choice. In contrast to the results of Experiment 1, however, changes in preference did not appear until after 1 or 2 weeks of testing. Mean preference ratios for

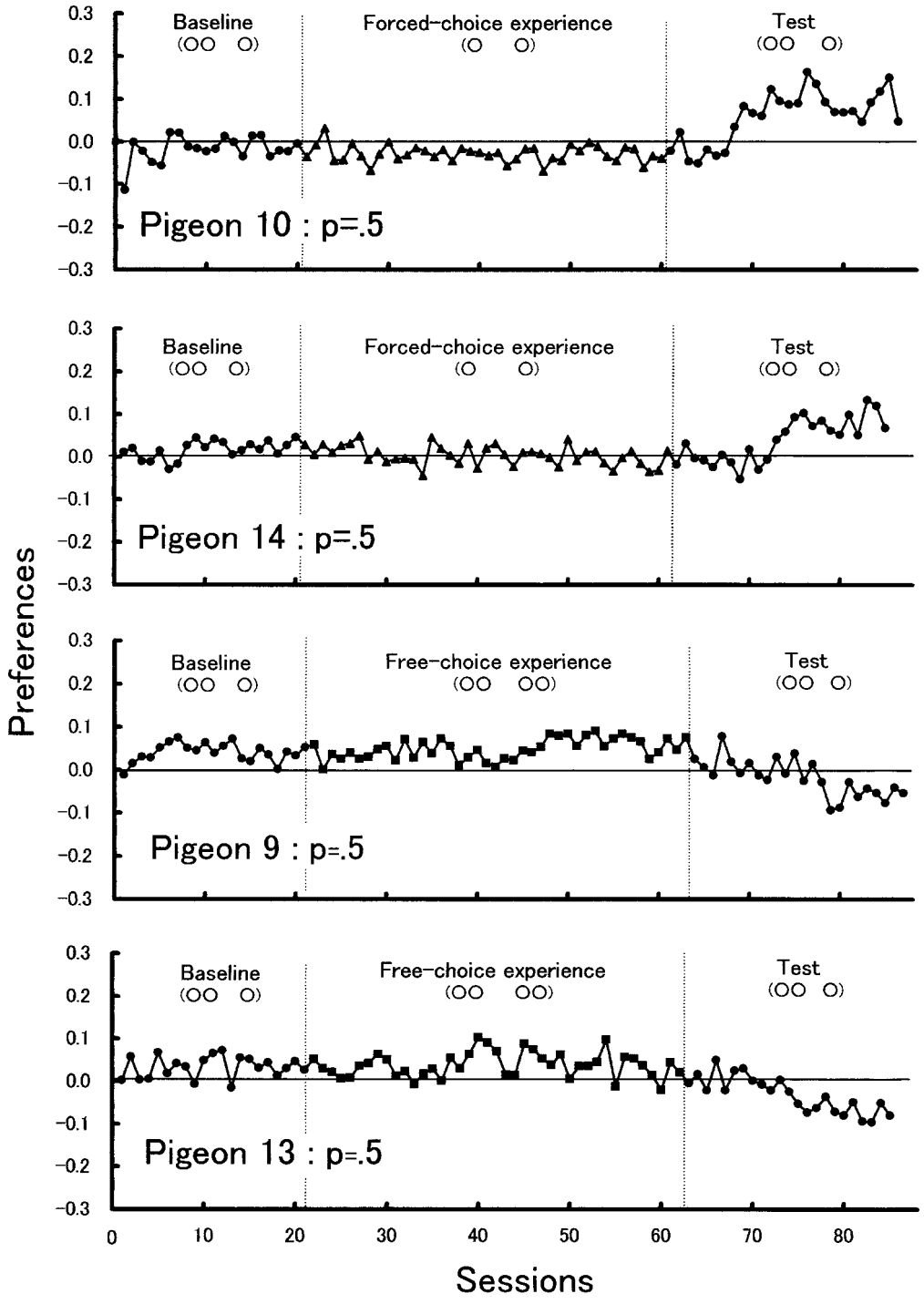

Fig. 2. Preference in baseline, experience, and test phases for the 4 pigeons for the two experience conditions in Experiment 2, in which probability of food delivery at the end of the terminal links was .5. If a pigeon prefers left (two green keys) during blue and right during white, preference will be positive, and vice versa. The dashed vertical lines divide the phases. The circles under the phase names represent the choice conditions presented in the terminal links (i.e., the double circle represents a free choice and a single circle represents a forced choice).

Table 1

Mean number of trials that pigeons chose each terminal link and mean pecks on that terminal link in the blue (B) and white (W) component. Data are from the last five sessions of baseline and experience phases and the first five and the last five sessions of the text phase for each pigeon of Experiment 2. The uppermost header shows the three phases, the second line shows the chosen terminal link, and third line shows the final terminal link chosen by each pigeon. L denotes left, C denotes center, and R denotes right terminal links.

		Phase:	Baseline (last five sessions)				Experience (last five sessions)			
		Last IL:	L		R		L		R	
		TL:	L	C	C	R	L	C	C	R
Pigeon 10	B	Trials	21.0	13.6		17.0	44.2			25.8
		Pecks	4.6	4.4		5.0	5.8			5.6
	W	Trials	43.8		21.0	19.4	36.4			20.8
		Pecks	4.3		4.4	3.9	4.5			4.7
Pigeon 14	B	Trials	8.2	12.8		42.4	22.4			35.8
		Pecks	8.2	9.5		8.6	7.4			6.2
	W	Trials	14.4		29.6	13.2	16.8			31.0
		Pecks	8.8		6.7	6.2	7.6			5.4
Pigeon 9	B	Trials	18.0	19.0		33.0	14.8	23.8	17.0	16.0
		Pecks	4.5	4.3		3.8	3.2	2.8	2.2	3.1
	W	Trials	40.6		21.2	8.6	16.2	24.2	11.8	11.6
		Pecks	4.3		3.3	3.0	3.5	3.2	2.8	3.3
Pigeon 13	B	Trials	10.8	30.0		28.2	11.4	27.2	21.2	8.2
		Pecks	5.2	5.4		5.4	5.1	6.5	6.8	5.8
	W	Trials	35.8		18.0	13.0	10.2	25.0	25.0	12.4
		Pecks	4.1		5.1	4.8	4.3	6.3	6.5	5.9

the last 10 sessions were 0.089 for Pigeon 10, 0.084 for Pigeon 14, −0.056 for Pigeon 9, and −0.069 for Pigeon 13. All data were above zero for the last 13 sessions for Pigeons 10 and 14, and all data were below zero for the last 10 sessions for Pigeons 9 and 13.

Like the data from Experiment 1, these data also demonstrated that in the test phase pigeons strongly preferred the alternative that they had not experienced in the prior experience phase. One distinctive feature of Experiment 2 was the delayed appearance of the shift in preference for all 4 pigeons.

Table 1 shows more detailed data on terminal-link performance in the last five sessions of the baseline and experience phases and the first five and last five sessions of the test phase for each pigeon in Experiment 2. If the performance of pigeons was not biased to a key position, the relative number of initial-link responses (Left/[Left + Right]) in the blue component will be the complement of the same measure in the white component. If performance was biased to the left alternative in both the blue and white components, however, this complementarity will not hold, and the sum of the relative measures will be greater than 1 for a left-key bias and less than 1 for a right-key bias. Most pigeons had position biases toward either the left or right key in the initial links and toward the center key in the case of the free-choice terminal links, with some exceptions (e.g., baseline and first five sessions of the test phase during the white component for Pigeon 10). There was no systematic trend throughout phases and conditions. There also were no clear differences between terminal-link performance in the first and last five sessions in the test phase.

GENERAL DISCUSSION

To examine how experience affects preference between forced choice and free choice, two experiments were conducted. In Experiment 1, which arranged a reinforcement probability of 1.0 at the end of the terminal links in multiple concurrent-chains schedules, the pigeon that had recent forced-choice experience showed transient free-choice preference in the test phase, the pigeon that had recent free-choice experience showed transient forced-choice preference, and the pigeon that had both forced-choice and free-choice experience showed no pref-

Table 1
(Extended)

Test (first five sessions)				Test (last five sessions)			
L		R		L		R	
L	C	C	R	L	C	C	R
17.2	22.2		19.2	18.2	29.0		21.0
3.5	3.8		3.2	3.2	3.2		3.4
38.8		16.2	18.0	32.8		17.4	13.8
3.2		3.5	3.6	3.6		3.4	4.2
10.0	16.4		40.6	8.8	17.2		39.2
6.4	7.7		8.2	5.7	6.5		7.3
14.6		29.0	16.2	12.8		23.8	12.0
5.3		6.1	4.3	6.8		4.5	6.7
16.0	17.4		25.8	17.6	22.4		33.2
2.2	2.9		4.7	3.7	3.2		3.5
37.6		21.8	12.4	36.8		14.2	14.0
4.1		3.6	3.5	3.8		3.2	3.3
14.0	36.0		29.2	14.0	32.2		39.8
3.6	5.8		4.9	5.2	5.4		6.2
33.8		18.8	12.8	27.8		15.4	6.4
3.6		5.6	4.6	5.5		5.2	2.4

erence. In Experiment 2, in which reinforcement probability at the end of the terminal links was .5, the 2 pigeons that had a forced-choice experience also showed free-choice preference, and the 2 pigeons that had a free-choice experience showed forced-choice preference, but for all 4 pigeons, this preference took 7 to 14 sessions to appear (Figure 2).

Data from the baseline phases in both experiments showed slight but consistent preferences for free choice over forced choice in 5 of 7 subjects; Pigeon 13 in Experiment 1 and Pigeon 10 in Experiment 2 showed no preference for either of the two terminal links. These findings correspond to those of previous studies with animals (Catania, 1975, 1980; Catania & Sagvolden, 1980; Cerutti & Catania, 1986; Cerutti & Catania, 1997; Suzuki, 1999; Voss & Homzie, 1970).

In the experience phase, 4 subjects (all 3 pigeons in Experiment 1 and Pigeon 14 in Experiment 2) showed no consistent preference. Pigeons 10, 9, and 13, however, showed small preferences in Experiment 2: Most of the data points fell below zero for Pigeon 10 and above zero for Pigeons 9 and 13, although the arrangement of both terminal links was exactly the same. There seem to be a number of possible explanations for the preferences shown in the experience phase. One is that these may have resulted from position biases that differed between the two components and that had been established through long exposure to multiple concurrent-chain schedules before these experiments. Another is that the biases may have carried over from the baseline phases, although this seems unlikely given that the duration of the baseline phase was brief and the biases continued throughout the longer experience phase. Finally, these sustained preferences could have resulted from the measure used here being vulnerable to position bias.

Preference levels during the test phases, however, were distinctly different from those in the baseline and experience phases. In Experiment 1, the 2 pigeons exposed either to free or forced choice as prior experience clearly shifted preference to the alternative with which they had no recent experience. The shifts returned to indifference after about 20 sessions, however, consistent with the previous suggestions of Freeman and Lattal (1992) and Ono and Iwabuchi (1997).

The data from Pigeon 9, which was exposed to both forced-choice and free-choice experiences, showed no preference shift in the test phase. The data from Pigeon 9 are therefore consistent with the changes shown by the other 2 pigeons, and act as a control condition.

In the test phases, the results of Experiment 2, in which reinforcers were available at the end of the terminal links with a probability of .5, were similar to those of Experiment 1. A difference worthy of note, however, is that the shifts in preference did not take place immediately—from 7 to 14 sessions were necessary before preferences began to shift. Further experiments may be necessary to clarify the conditions under which this delayed preference may occur.

The results clearly showed that preferences between forced choice and free choice could be affected by prior experience. Pigeons' preference for the contingency with which they had no recent experience may stem from a preference for novelty. Many studies have suggested that various species, including humans, show novelty preference (Dellu, Piazza, Mayo, LeMoal, & Simon, 1996; Uehara, 2000; Vallortigara, Regolin, & Zanforlin, 1994). Pigeons' preference for stimulus variety (Catania, 1975, Catania & Sagvolden, 1980) may also be relevant. In the present study, however, stimuli that did not exist in the experience phase were not literally novel because they had previously been presented in the baseline phase—they were simply different from recent contingencies. Thus preference for novelty per se is probably not a viable explanation, but we can conclude that pigeons preferred the contingency that they had not experienced immediately before testing.

The results of the present study may also have wider implications for the role of experience in animal and human choice. To generalize these findings, it will be necessary to examine whether similar results can be obtained with other types of prior experience, such as in procedures for determining preference between informative and uninformative stimuli, between fixed-interval and variable-interval schedules, and so forth, in both humans and animals.

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