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11 Discriminative Property of Visual Arts for Java Sparrows, *Padda oryzivora*

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I. Introduction

Creating and appreciating art have been considered abilities limited to humans. However, some birds sing complex songs and others create beautiful nests. Female birds generally evaluate these 'art-like' products when selecting their mates. Previous studies suggest that birds discriminate between two different pieces of art such as music or paintings even when created by humans. Both songbirds and non-songbirds have this ability for music. Java sparrows can distinguish between classic and modern music (Watanabe & Sato, 1999). Starlings (Hulse et al., 1995) also have the ability to distinguish between different music types. In the case of paintings, Watanabe et al. (1995) showed how pigeons could distinguish between and categorize two different paintings by Monet and Picasso. However, this ability has not been examined in songbirds.

The aim of this study is to investigate the stimulus property of visual arts in songbirds, particularly Java sparrows. Visual and acoustic stimuli present much information to songbirds. When acoustic cues were ambiguous, songbirds used visual cues to distinguish individuals (Watanabe & Jian, 1993). The visual stimuli of bodily features such as head and face colours help them recognize dominance (Pryke & Griffith, 2006) and choose mates (Johnson, 2002). Therefore, visual perception is well developed in songbirds and is an ability that they can apply to human-made complex visual art. If these discriminative abilities are found in both song and non-songbirds, it would suggest that sensory faculty towards ‘art’ is common in humans and birds.

II. Method

1. Subjects

Five adult male Java sparrows (*Padda oryzivora*), obtained from a pet shop, were used. Two birds (B9 and B10) were experimentally naive, but the others (B1, B6, and B7) had experienced a visual test before. They were housed individually under 12:12-h light:dark cycle. Room temperature was maintained at 23°C. All birds were maintained at 90% of their free feeding weights during the experiment. Water was continuously available.

2. Device

The experimental chamber was a small bird cage (15 cm × 30 cm × 20 cm) with two perches. An optical sensor fixed on each perch detected the position of the birds. A food tray connected to a dispenser (Okubo Instruments, Tokyo) was placed along the sides of one perch (response perch). The dispenser was designed to drop a few seeds of millet onto the tray. A TV monitor (8.5 cm x 11.5 cm, SHARP, 6E-A8) was placed in front of the response perch. The distance between the response perch and the monitor was 10 cm. In front of the TV monitor was a liquid-crystal shutter (12.2 cm × 12.2 cm, NSG UMU PRODUCTS). The chamber was placed in a sound-insulated box (37 cm × 62 cm × 59 cm). A computer (Dell, Optiplex) controlled the experiment through MED SKED system.

3. Procedure

Stimuli: Three painting categories, Japanese-style, Modern-style, and Western-style, were used. All the paintings were taken from picture books with a digital camera (Nikon, D80) and edited by Adobe Photoshop 7.0.1 software. In discriminative training, 20 different paintings of two categories were used. Stimuli not used in discriminative training were used in the generalization test.

Pre-training: The birds were trained to move from a ‘ready perch’ to a ‘response perch’ to get food. They were then trained to stay more than 3 seconds on the ready perch before moving to the response perch. Moving to the response perch was reinforced with food. During this training, no stimulus appeared on the screen.

Discriminative training: Birds were divided into Modern-Western (MW)or Western-Japanese (WJ) groups. Two birds (B6 and B9) were assigned to the MW group and the other three (B1, B7, and B10) to the WJ group. In both groups, the birds were trained to perch when Western paintings (S+) appeared on the TV monitor. Therefore, the MW group was trained to respond to the Western paintings (S+) but not to the Modern paintings (S–), and the WJ group was trained to respond to the Western paintings (S+) but not to Japanese paintings (S–). When the subjects stayed on the ready perch for 3 seconds, the stimulus appeared on the TV monitor. Then, moving to the response perch within 3 seconds (limited hold) resulted in food delivery when the stimulus was S+ (HIT). No response for 3 seconds was assigned as a MISS. When S– appeared, moving to the response perch resulted in a 12-second blackout period (FA: false alarm). No response for 3 seconds was assigned as CR (correct rejection). After the MISS and FA trials, the same trial was repeated until the birds responded correctly. In cases where subjects failed to attain the correct response ratio (dividing the sum of HIT and CR by 40) above 0.8 in over three successive sessions, the limited hold was changed to 2 seconds. Once the correct response ratio above 0.8 was attained in two successive sessions, the limited-hold was turned back to 3 seconds. One session consisted of 40 trials in which 10 S+ and S– paintings were twice presented in accordance with Gellerman series. The training continued until the birds attained a correct response ratio above 0.8 in three successive sessions. In cases where the birds failed to reach the criterion of 0.8 correct response ratio within 100 sessions, they were not tested further. Only the sessions in which subjects cleared all 40 trials in one session were used for analysis.

Generalization test: Five test sessions were performed. As mentioned earlier, one test session consisted of 40 trials. In every test session, eight of the training S+ and S– stimuli were each presented twice. In addition to those 16 stimuli, 2 novel S+ and S– stimuli, which were never presented during the discriminative training, were each presented twice and in accordance with Gellerman. This test session was repeated 5 times, so that 10 novel S+ and S– were tested in total. During the test sessions, reinforcement was available for response to both old and novel S+ stimuli. The testing procedure was identical to the discriminative training except for the stimuli and the correction trials. Correction trials were not used in the generalization test.

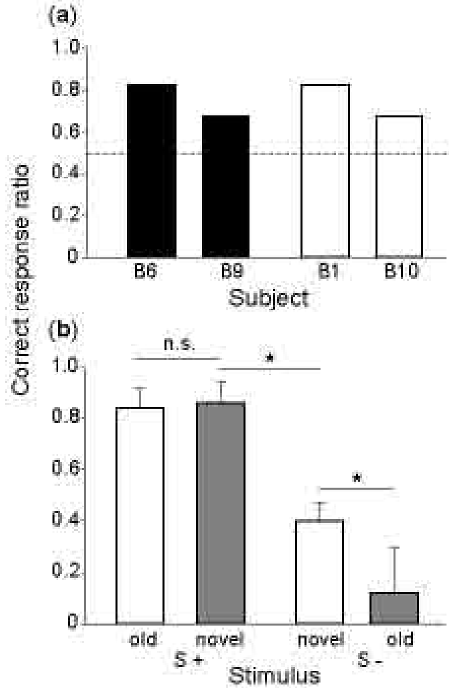

Figure 1. Results of the generalization test. (a) Subjects showed generalization to novel stimuli both in JM (black bars) and MW (white bars). (b) The correct response ratio to the novel stimuli was significantly different between S+ and S–. Paired t-test through the correct response ratio was performed at the significance level of 0.05. Error bars show +1SD.

III. Result and Discussion

Four Java sparrows attained 0.8 correct response ratio. One, however, did not reach the criterion after 100 sessions of discriminative training and was excluded from further testing. The fastest bird attained the criterion by 34 sessions and the slowest by 91 sessions. T-test revealed that the number of training sessions were not significantly different between the two groups (t_2= 0.20, *n.s.*). These results suggest that Java sparrows are capable of discriminating two painting categories.

In the generalization test, two of four subjects maintained their correct response ratio to the novel stimuli, although the ratios were lower than 80% (Figure 1(a)). One sample t-test (expectation = 0.50) revealed a significant difference from the expectation (t_3 = 5.77, p = 0.010). It suggests that Java sparrows showed the generalization to novel stimuli. The correct response ratios to the training stimuli were maintained in the generalization test (Figure 1(b)). Paired *t*-test through the correct response ratio revealed a significant difference in novel stimuli between the S+ and S– paintings ($t_3 = 6.44$, $p = 0.008$) and in S– paintings between the novel and old stimuli ($t_3 = -4.43$, $p = 0.021$). It was not significantly different in S+ paintings between the old and novel stimuli ($t_3 = -0.93$, $p = 0.422$). These results showed that Java sparrows were able to discriminate novel paintings on the basis of learned painting category discrimination.

These results are consistent with the findings that pigeons showed stimulus generalization of paintings from Monet to Cezanne and Renoir and from Picasso to Braque and Matisse (Watanabe et al. 1995). It suggests that pigeons' behaviour can be based on categorization. Therefore, the results also suggest that both non-songbirds and songbirds can differentiate between paintings and categorize complex visual stimuli.

Visual perception is highly developed in birds. Brown & Dooling (1992) show that budgerigars distinguish between faces of conspecifics. Furthermore, Brown & Dooling (1993) show that budgerigars can distinguish between faces even when the stimuli are computerized images. Their results imply that birds can use these visual cues in the wild as well as in the experimental room. It has also been reported that birds show the generalization to music stimuli. Pigeons showed stimulus generalization from Bach to Baxtehude and Scalatti (Porter and Neuringer, 1984). Java sparrows indicated the generalization of classic music from Bach to Vivaldi (Watanabe and Sato, 1999), demonstrating classification very similar to that performed by humans. These results indicate the similarity of sensory perception between songbirds and humans.

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