



Paintings discrimination by mice: Different strategies for different paintings



Shigeru Watanabe*

Keio University, Department of Psychology, Mita 2-15-45, Minato-Ku, Tokyo, 108, Japan

ARTICLE INFO

Keywords:

Visual discrimination
Visual concept
Generalization
Painting
Art

ABSTRACT

C57BL/6 mice were trained on simultaneous discrimination of paintings with multiple exemplars, using an operant chamber with a touch screen. The number of exemplars was successively increased up to six. Those mice trained in Kandinsky/Mondrian discrimination showed improved learning and generalization, whereas those trained in Picasso/Renoir discrimination showed no improvements in learning or generalization. These results suggest category-like discrimination in the Kandinsky/Mondrian task, but item-to-item discrimination in the Picasso/Renoir task. Mice maintained their discriminative behavior in a pixelization test with various paintings; however, mice in the Picasso/Renoir task showed poor performance in a test that employed scrambling processing. These results do not indicate that discrimination strategy for any Kandinsky/Mondrian combinations differed from that for any Picasso/Monet combinations but suggest the mice employed different strategies of discrimination tasks depending upon stimuli.

1. Introduction

Painting or drawings first came into existence as a way to represent real objects. These works of art were typically produced by humans for humans. Ancient cave paintings suggest that humans have been painting for more than 40,000 years (Pike et al., 2012). A painting is not a simple transfer of a 3D object onto a 2D canvas, but a transformation depicted through the inner creative process of the painter/artist. Therefore, paintings of a particular artist often share common features, and we can guess the identity of the artist from the appearance of the paintings. Pigeons can also distinguish paintings by Monet from those by Picasso (Watanabe et al., 1995), paintings by Chagall from those by Van Gogh (Watanabe 2001), and Japanese paintings from Western impressionist paintings (Watanabe 2011). The birds display generalization to new paintings that had not been previously evident during discriminative training. My previous reports have also shown discrimination between “good” and “bad” children’s paintings in pigeons (Watanabe 2010, 2011). Ikikatai and Watanabe (2011) trained Java sparrows to discriminate cubists from impressionists, and found that they could also discriminate between these paintings.

One similarity between humans and birds is the highly developed visual system that might be the basis of such behavior. In contrast to birds, most rodents are nocturnal animals, suggesting dominance of the non-visual senses over the visual sense; however, mice seem to use visual cues for social cognition (Langford et al., 2006). They also show preference for videos of sexual and fighting behavior of conspecifics (Watanabe et al., 2015). In fact, mice exhibit fine visual cognition to

discriminate between complex non-social visual stimuli. Watanabe (2013) trained C57 mice in simultaneous discrimination of a pair of paintings by Kandinsky and Mondrian in an operant chamber equipped with a touch screen. After reaching the criterion of the discrimination task, the subjects were trained with a new pair of paintings by the same artists. These mice were successively trained on four different pairs of paintings. They required 31.5 sessions on average ($N = 4$) to learn the first task. To learn the fourth task, the mice needed just two to four sessions. Thus, the subjects were able to discriminate between paintings from the two artists and transfer the discriminative ability to novel stimuli, suggesting category-like discrimination of painting styles.

Most studies have demonstrated category-like discrimination using discriminative training with multiple exemplars. Here, I examined painting discrimination in mice using simultaneous discrimination with multiple exemplars. One group of mice was trained in discrimination between three paintings by Kandinsky and Mondrian each, and the other group were trained in discrimination between three paintings by Picasso and Renoir each.

2. Materials and methods

2.1. Animals

Eight male C57/BL/6 mice were used. They were obtained from the Nihon Biomaterial Company, and were 8 eight weeks old at the beginning of the experiment. Mice were housed in a room under reversed 12D/12L lighting conditions with a constant temperature of 24 °C. Food

* Corresponding author.

E-mail address: swat@flet.keio.ac.jp.

was freely available, but water was available for 3 h after daily experiments. All animals were treated in accordance with the guidelines of National Institutes of Health guide for the care and use of Laboratory animals (NIH Publications No. 8023, revised 1978), the Animal Care and Use Committee of Keio University, and the guidelines of the Japanese Society for Animal Psychology.

2.2. Apparatus

An operant chamber with a touch screen (Model 89541, Campden Instruments) was used for conditioning. The touch screen was located on the front panel (25 cm × 20 cm), and a liquid dispenser and its tray were located on the rear panel (5.5 cm × 20 cm). Another panel with two rectangular windows (8 cm × 7 cm, separated from each other by 0.5 cm) was placed in front of the touch screen. The liquid dispenser provided 7 µl of 10% condensed milk as a reward. A PC (GIGABYTE) controlled the experiment through the ABET II programming software.

2.3. Stimuli

Four pairs of paintings by Kandinsky and Mondrian and four pairs by Picasso and Renoir were selected (see Table 1). The paintings were trimmed to produce square-shaped stimuli. The size of the stimuli on the display was 7.4 × 7.4 cm and the distance between the stimuli was 0.5 cm. The luminance of each painting, at the approximate position of the head of a mouse, was measured by a luminance meter (T-10MA, Konica-Minolta Optics) and the corresponding values are presented in Table 1. The average luminance by Kandinsky was 102.01 lx (ranging from 78.8 to 151 lx), that by Mondrian was 90.78 lx (ranging from 68.1 to 118 lx), that by Picasso was 70.4 lx (ranging from 45.5 to 84 lx), and that by Renoir was 72.73 (ranging from 33.8 to 94.5 lx). There was no significant difference in luminance between paintings by Kandinsky and Mondrian (two-tailed *t*-test, *t* (6) = 0.53, *P* = 0.60, *d* = 0.35) or between paintings by Picasso and Renoir (*t* (6) = 0.15, *P* = 0.89, *d* = 0.10). Two different modifications of the paintings were used for testing. In pixelation test, pixelated stimuli consisting of 6.7 × 6.7 mm units were used. The Adobe Photoshop (version 8.1) software was used and the average brightness and color information per unit area were preserved; however, no information about the shape within the area was noted. In scrambling test, the original paintings were divided into 4 × 4 units, and those units were then randomly mixed to produce scrambled stimuli. The horizontal and vertical direction of each unit was not changed; thus, the left-right and top-bottom directions were maintained. Example of these modifications is presented in Fig. 3.

Table 1
Stimuli and their luminance.

Stimuli	Kandinsky	Lux	Mondrian	Lux
Pair 1	Composition VIII (1923)	83	COMPOSITION NO.IV; COMPOSITIE 6 (1914)	102.7
Pair 2	Composition IX (1936)	96	Composition with Yellow, Blue, and Red (1937)	118
Pair 3	Yellow-red-blue (1925)	151	Composition with Color Plane (1914)	76.3
Pair 4	Accent in rose (1926)	78.8	Composition with Grid 9; Checkerboard with Light Colors (1919)	68.1
Stimuli	Picasso		Renoir	
Pair 1	Girl Before a Mirror (1932)	45.5	Springtime (in Chatou) (1875)	94.5
Pair 2	Guitar, Glass and Fruit Bowl (1924)	79	Rowers at Argenteuil (1873)	76
Pair 3	Wine Bottle (1926)	73	Rowers at Chatou (1880)	86.6
Pair 4	Woman in a Yellow Armchair (1932)	84	Women in a Garden (1876)	33.8

2.4. Procedure

The subjects were divided into KM (Kandinsky vs. Mondrian discrimination) and PR (Picasso vs. Renoir discrimination) groups of four individuals each. After shaping the touch response to the screen, the mice were trained for pairwise discrimination. A “free” reward (7 µl 10% condensed milk) was dropped onto the tray, and a nose poke to the tray started the first trial. The K1 stimulus was associated with reward (S+) and the M1 stimulus was not associated with reward (S−) for the KM group. Similarly, the P1 stimulus was associated with reward S+ and the R1 stimulus was not (S−) for the PR group. The two images were presented on the screen. A touch on the correct image (S+) resulted in delivery of the reward, and this was accompanied by a tone (3 kHz, 1000 ms). A nose poke into the tray turned off the tray light and the inter-trial interval (10 s) began. If the mouse touched the incorrect image (S−), no reward was given and the correction trial was started. The correction trial consisted of re-presentation of the same set of stimuli, and was repeated until the mouse touched the correct image. The respective sides that were correct (S+) and incorrect (S−) were pseudo-randomly determined. One session consisted of 20 trials, or the duration of 60 min. The criterion of discrimination was more than 85% correct choices during two successive sessions.

When this criterion was achieved, the first generalization testing with a novel pair of stimuli (K2 and M2 for the KM group, and P2 and R2 for the PR group) was carried out for two sessions. The procedure for the test was identical to that for the training, except for the stimuli used. Thus, correction procedure and reinforcement were effective during the test. Mice then received the second discrimination training with the original stimuli (K1 and M1, or P1 and R1) and the novel pair of stimuli (K2 and M2, or P2 and R2). Two different S+ and S− associated images were randomly presented pairwise. One session consisted of 24 trials or 60 min duration. When the mouse reached the criterion (two successive sessions of over 85% correct responses), the second generalization testing (20 trials) with a novel pair of stimuli (K3 and M3, or P3 and R3) was carried out for two sessions. Mice then received the third discrimination training with the six stimuli, namely, two previous S+ and S− (K1, K2, M1, M2 or P1, P2, R1, R2), and two novel stimuli (K3 and M3, or P3 and R3). One session consisted of 36 trials or 90 min duration. When the mouse reached the criterion, the third generalization testing (20 trials) with a novel pair of stimuli (K4 and M4, or P4 and R4) was carried out for two sessions. After the third generalization test, mice received the third discriminative training to maintain their discriminative behavior.

When they maintained the discriminative behavior (two successive sessions with over 85% correct responses), two tests were carried out. One was the pixelization test that consisted of 20 trials with the pixelated image of the first pair of stimuli (K1 and M1 or P1 and R1). After this test, mice were subjected to discriminative training to maintain the discriminative behavior. If the subjects maintained the discriminative behavior, the scramble test was carried out. This test consisted of 20 trials with a scrambled image of the first pair of stimuli.

3. Results

3.1. Acquisition

Fig. 1 presents the number of sessions that were required to attain the criterion of discrimination. Two-ways ANOVA (group × series of trainings) revealed a significant effect of the group (*F* (1, 23) = 4.42, *P* = 0.049, η^2 = 0.12) and the interaction (*F* (2,23) = 5.90, *P* = 0.11, η^2 = 0.34) but not the trainings (*F* (18, 23) = 0.43, *P* = 0.66, η^2 = 0.02). The KM group required 32.7 sessions in the first training task, 11.8 sessions in the second training task, and 5.5 sessions in the third training task. Each subject showed improvement of acquisition following the three training tasks. Paired *t*-test following Holm's correction for multiple comparisons revealed a tendency of difference

Download English Version:

<https://daneshyari.com/en/article/5539589>

Download Persian Version:

<https://daneshyari.com/article/5539589>

[Daneshyari.com](https://daneshyari.com)