

Behavioral analysis of visual discrimination of sex in female macaque monkeys

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Abstract. In this study, the performance of visually guided sex discrimination and sex preference tasks were investigated in female macaque monkeys to elucidate visual functions in sex discrimination. In the sex discrimination task, monkeys were able to discriminate the sex of a monkey shown in pictures on a computer display. During the discrimination task, some neurons in the orbitofrontal cortex responded specifically to pictures of either male or female monkeys. In the sex preference task, some monkeys watched video movies of either males or females significantly longer than female or male movies, respectively. This preference tendency was consistent with each individual. These results indicated that visual information alone was sufficient to discriminate sex and produce sex preference. The orbitofrontal cortex may be one of the sites responsible for sex discrimination. © 2007 Published by Elsevier B.V.

Keywords: Macaque monkey; Sex discrimination; Preference; Orbitofrontal cortex

1. Introduction

Visual information about face and body, including facial expression and bodily behavioral patterns, play an important role in social and emotional communication in monkeys. In choosing breeding partners, visual information is very important in monkeys. In the present study, to elucidate the function of vision in sex discrimination, 1) visually guided sex discrimination and 2) preference of sexuality were investigated in macaque monkeys performing operant bar-press tasks. Additionally, 3) analysis of neuronal activity

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during the sex discrimination task in the orbitofrontal cortex (OBF), the region related to both value judgment for rewards and vision information processes, was conducted.

2. Materials and methods

In the sex discrimination task, two female monkeys (*Macaca mulatta*) were trained to discriminate the sex of a monkey shown in a picture that was presented on the display (Fig. 1A). The pictures (males and females) were selected randomly from a photographic database in a computer. The monkey pressed the right or the left bar for a male or female monkey, respectively, to obtain water as a reward. Neuronal activities during the peri-visual stimulus periods were extracellularly measured in OBF using glass-coated Elgiloy electrodes.

In the sex preference task, three female rhesus monkeys and three female Japanese monkeys (*M. fuscata*) were used. The monkeys voluntarily pressed a bar to watch the video movie showing either male or female rhesus monkeys (Fig. 1B). We prepared video movies of 1) rhesus males that were taken in the breeding season (winter), 2) rhesus males that were taken in the non-breeding season (summer), 3) rhesus females that were taken in the breeding season and 4) rhesus females that were taken in the non-breeding season. Additionally, movies of mixed-sex rhesus monkeys, mixed-sex Japanese monkeys, scenery from a Japanese national park and a blank tape were prepared as controls. The total duration of the bar-press responses for watching videos in daily sessions was measured as the index

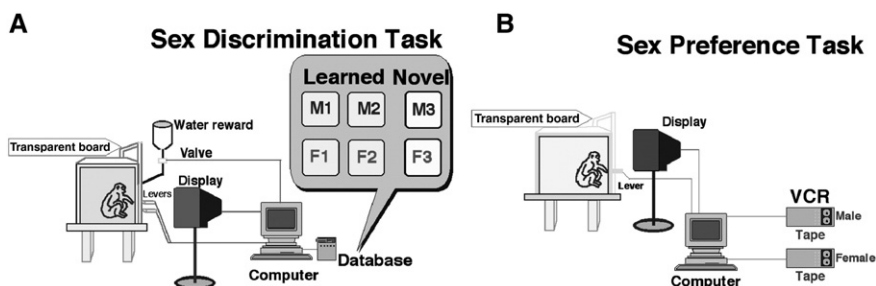


Fig. 1. Experimental apparatus for the sex discrimination task (A) and the sex preference task (B). A monkey was put into a cage that had a transparent board facing a display. (A) Following a cue tone to signal the start of each trial, a color picture of either a male or a female monkey was presented for 4.4 s on the display. Each picture was randomly presented ten times from six pictures (three males and three females) in one session (total of 60 trials in one session). The monkeys were trained to press either the right or left bar responding to a picture of a male or a female monkey, respectively. When correctly performed, drinking water (1.5 ml) was automatically given as a reward. Discrimination of four of the six pictures had already been learned in the previous sessions, while the remaining two pictures of a male and a female were new. When the novel pictures were learned (90% correct response, 18 out of 20 trials), two old pictures (male and female) were discarded and two new pictures were introduced in the upcoming session. (B) Each monkey was put into the cage for 90 min. One side of the cage had a bar and a transparent board facing a TV display. Monkeys voluntarily pressed the bar to watch the video movie of either male or female monkeys taken at outdoor breeding colonies of rhesus monkeys. The movie was presented as long as the subject monkey kept pressing the bar. When the monkey released the bar, the movie was turned off. The same movie was continued if the monkey pressed the bar within 10 s of the previous release of the bar. When 10 s passed after the release of the bar, the movie was changed to another one [1].

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