

Responses to Animal Stimulus Photographs in Stumptailed Macaques (*Macaca arctoides*)

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ABSTRACT. Interest in their animate environment was studied in a captive group of 11 stumptailed macaques (*Macaca arctoides*). Subjects were shown projected photographic slides, most of which showed a single individual primate or non-primate. The measure of interest was the duration of viewing. Results showed that adult females exhibited more interest towards stumptailed macaques versus other macaques species, and towards adult females carrying infants versus adult females alone. Data concerning non-primates showed that subjects were especially interested by photographs of felids; this effect was partly due to the presence of two frontal and conspicuous eyes in felids.

Key Words: *Macaca arctoides*; Photographic stimuli; Visual patterns.

INTRODUCTION

Vision is one of the most important senses in primates. In view of the performances of these animals in cognitive tasks, and the complexity of their social environment, it is clear that they possess sophisticated visual recognition and discriminatory abilities. A growing number of studies aim to assess how individuals perceive their animate environment and, in particular, to identify significant features of the environment for the animal. The stimulus used may be live animals presented behind glass (SACKETT, 1970; ROSENBLUM & ALPERT, 1977), mirrors (GALLUP, 1968; ANDERSON, 1984), dummies (CHENEY & SEYFARTH, 1981), videotapes or motion pictures (PLIMPTON et al., 1981; HERZOG & HOPF, 1986), or photographs (HUMPHREY, 1972; HAUDE & DETWILER, 1976; ANDERSON & CHAMOVE, 1984). It was shown that animals directed differential responses towards such stimuli.

The use of photographs as stimuli has been one of the most frequently used methods. For instance, it has been demonstrated that rhesus macaques (*Macaca mulatta*) recognize familiar conspecifics by facial cues only (ROSENFELD & VAN HOESEN, 1979), and they respond differently according to the kind of facial expressions displayed (SACKETT, 1966). Using learning techniques, several authors have shown that monkeys can discriminate between categories of visual stimuli: macaques differentiate between conspecifics, humans, and objects (SANDS & WRIGHT, 1982; SCHRIER et al., 1984) and even between several species of macaques (SWARTZ, 1983; YOSHIKUBO, 1985); in addition, by presenting slides displaying pairs of individuals, DASSER (1986) recently demonstrated that long-tailed macaques (*Macaca fascicularis*) are aware of kinship relations between familiar individuals.

However, discrimination learning techniques give little information on the interest of subjects in the stimulus presented, excepted when the reward itself is the object of study (cf., e.g., BUTLER, 1965). Usually, spontaneous choice is used to evaluate differential interest of subjects in the stimuli. Using a two-choice viewing situation, HUMPHREY (1974) found that rhesus macaques prefer their own species to domestic mammals. HIGLEY et al. (1987) showed

that female rhesus macaques prefer immature conspecifics with neonatal-like facial skin coloration. Also, SWARTZ (1980) found that long-tailed macaques display different viewing durations depending on the macaques species presented. FUJITA and MATSUZAWA (1986) showed that a chimpanzee exhibited longer viewing duration towards human slides than towards non-human slides.

The aim of the present research was to study spontaneous responses of stumptailed macaques (*Macaca arctoides*) towards social and non-social photographic stimuli in order to assess their interest for several different categories.

METHODS

SUBJECTS

The subjects were 11 adult stumptailed macaques, 1 male and 10 females, 8 were wildborn and imported as juveniles, 3 were born in captivity and socially reared. They were housed in a 50 m² cage comprising four parts but, during tests, they were enclosed in one part (10 m²).

PROCEDURE

Subjects were shown projected color photographic slides. The experimental apparatus consisted of a rectangular projection chamber with a projector at one end, and a glass screen on the other end. The projected images were 56 cm high and 44 cm wide.

There were two series of slides: 119 representing non-human primates (20 different species, including 5 species of macaque represented by various age and sex classes) and 56 non-primate vertebrates (birds, ungulates, and carnivores). Most of them displayed a single individual face-one or three-quarters, with a neutral facial expression; some slides displayed adult female monkeys carrying infants (Fig. 1).

Tests session took place between 08:30 and 12:30, six slides being presented in each session. Each trial (presentation of one photograph) lasted 15 min, with intervals of 15 min between two successive trials. Each series of slides was presented three times, the order of presentation being randomised. This procedure was repeated, a 4-month interval separating the two experiments.

To assess the interest of individuals towards the slides, duration of viewing the screen was recorded. Only the behaviour of individuals settled in a 2 m² area was recorded, using a Data-myte. This area was located just in front of the screen and represented the optimal viewing region for the subjects.

Other responses recorded include frequency of viewing and presence in the viewing area. These measures gave either non-significant results or results consistent with the duration of viewing; therefore, they are not reported. Facial expressions were too rare to permit a quantitative analysis.

ANALYSIS

The mean duration of viewing was calculated for each individual from the three pooled presentations of each slide. For tests with non-human primate slides, only four females were in the area frequently enough to obtain means for all slides and, for non-primate slides, only

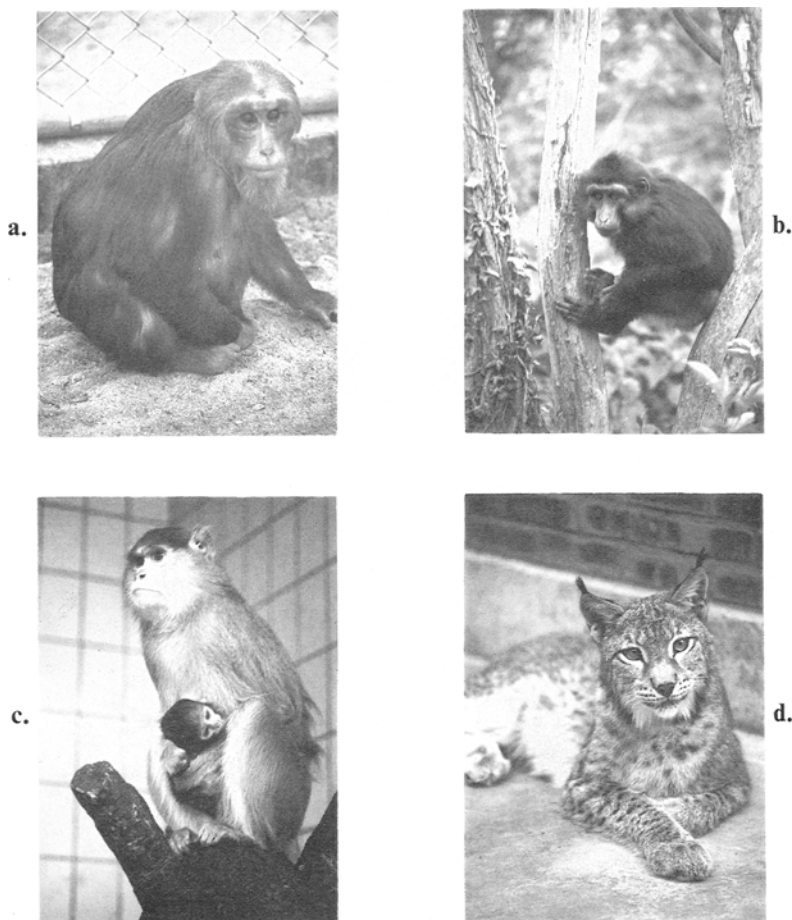


Fig. 1. Examples of slides displayed to the subjects. **a.** Adult female stumptailed macaque; **b.** juvenile female Tonkean macaque; **c.** adult female patas carrying an infant; **d.** adult male lynx.

six females. Only data for these individuals were used. Data were analysed using repeated-measures analyses of variance, with slide categories representing the repeated measures. Numbers of photographs could vary from one analysis to another owing to the numbers of available slides.

RESULTS

SLIDES OF NON-HUMAN PRIMATES

Influence of Species, Age, and Gender

Responses of the subjects towards five macaque species (*Macaca arctoides*, *M. fascicularis*, *M. fuscata*, *M. mulatta*, and *M. tonkeana*) of two sexes and various ages (juvenile: 1–3 years, subadult: 3–5 years, adult: >5 years) were compared (Fig. 2). There were significant differences between species ($F = 5.0$; $d.f. = 4,12$; $p < 0.02$) and genders ($F = 21.1$; $d.f. =$

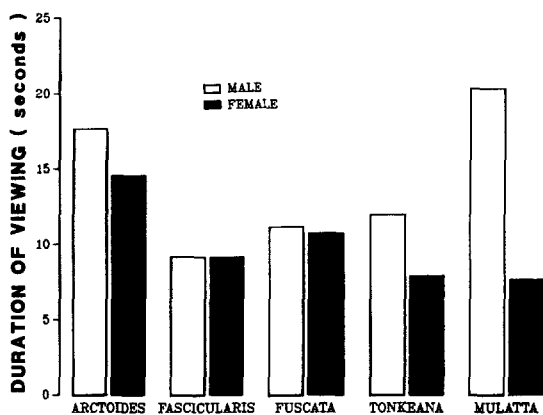


Fig. 2. Effect of species and gender. Five species of macaque were displayed on slides.

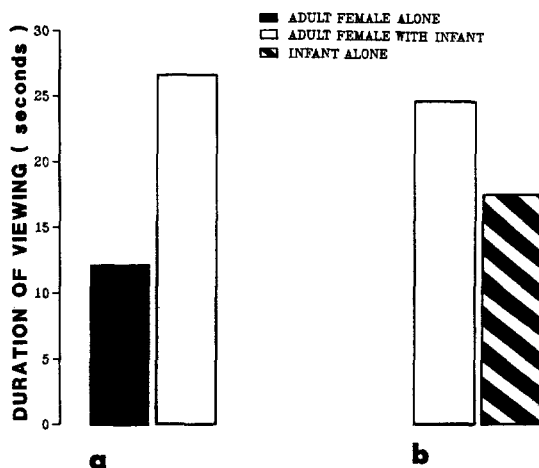


Fig. 3. Interest for infants. a. Comparison between adult female alone and adult female carrying and infant; b. comparison between adult female alone and infant alone. The two comparisons were conducted on different numbers of adult females.

1,3; $p < 0.02$) but not between age classes. These main effects were qualified by a gender \times species interaction ($F = 5.3$; $d.f. = 4, 12$; $p < 0.02$); rhesus males drew much more attention than did rhesus females while such an effect was much less evident for the other species. The subjects showed a longer overall viewing duration toward their own species.

Interest in Infants

To assess the subjects' interest in infants (individuals less than 1 year old), three analyses were conducted using slides of macaque and other cercopithecoid species. A first comparison tested the effect of an infant clinging to the mother compared with an adult female alone the first type of slide was more attractive ($F = 17.9$; $d.f. = 1, 3$; $p < 0.03$) (Fig. 3a). Second, a comparison between adult females carrying infants and infants alone showed no difference (Fig. 3b). A final analysis comparing juvenile individuals with infants alone showed no difference.

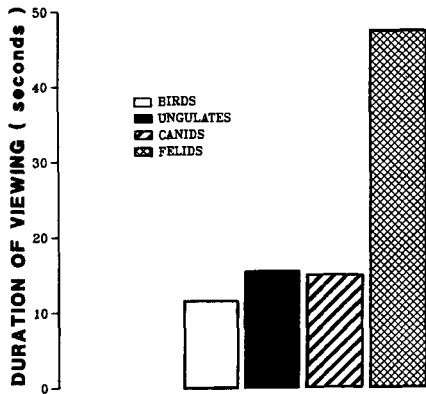


Fig. 4. Effect of the categories of non-primate vertebrates stimuli.

SLIDES OF NON-PRIMATE VERTEBRATES

Influence of Sizes of Photographs and Categories of Animals

In the tests described above, the size of the projected images were approximately life-size. In contrast, with the non-primate series, the variability in size of the species represented was considerable and not always related to the actual size. Therefore, a first analysis examined whether there was an effect of the size of the projected images. Mammals and birds were compared, each represented by three sizes (classification according to size was made by a person not involved in the study). No effect of size was observed but photographs of mammals were more attractive than those of birds ($F = 7.1$; $d.f. = 1,5$; $p < 0.05$).

To identify what kind of animals were the most attractive, mammals were divided in ungulates ($N = 10$), canids ($N = 5$), and felids ($N = 5$). The comparison among birds and these categories showed a significant difference ($F = 5.1$; $d.f. = 3,15$; $p < 0.02$); subjects looked longer at the felids (Fig. 4). It may be noted that certain photographs of felids were the only ones to provoke intense responses in the whole group (vocalizations, clasps, and mounts).

Testing the Effect of Eyes

Since felids elicited most looking, we asked what factor might be responsible for this effect. The only obvious characteristic of felids on the photographs was the presence of two frontal and conspicuous eyes. To test this variable, photographs were divided into two categories: animals having two frontal and conspicuous eyes, and animals not showing this feature. The following procedure was used: five persons not involved in the study were asked to classify the slides according to these categories, and a photograph was considered as belonging to the first category if it was selected by at least three persons. Twelve slides were thus selected: all the felids, three canids, one ungulate, and three birds.

To assess the possible effect of the eyes, a first analysis compared mammals and birds showing or not showing two conspicuous eyes. Duration of viewing was longer towards individuals possessing conspicuous eyes ($F = 6.6$; $d.f. = 1,5$; $p < 0.05$) (Fig. 5). A further comparison between birds and mammals was made but using only photographs without two conspicuous eyes: there was no significant effect. However, when individuals with or without conspicuous eyes were compared for birds, ungulates, and canids together, no signif-

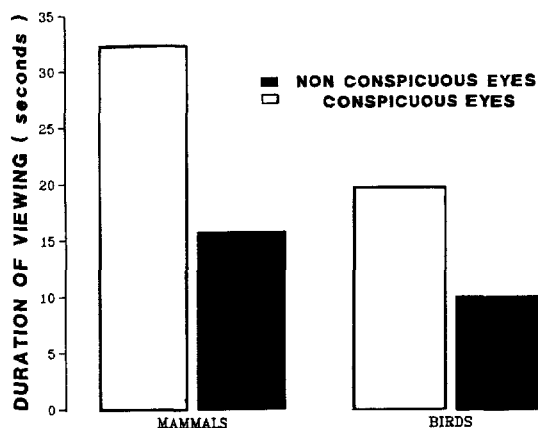


Fig. 5. Influence of the conspicuousness of eyes. Slides displaying animals with or without two frontal and conspicuous eyes were compared within mammals and within birds.

ificant difference emerged. Lastly, a comparison between felids and other animals with conspicuous eyes gave no significant effect, but the average obtained (mean for felids: 47.6; mean for other animals: 16.2) suggested the existence of other factors responsible for the felid effect.

DISCUSSION

Faced with slides representing non-human primates, adult female stumptailed macaques showed longer duration of viewing photographs of adult females carrying infants versus adult females alone, and towards stumptailed macaques versus other macaque species. The first result is consistent with what is known in the social context: in groups, females carrying infants are very attractive for other females (HRDY, 1976; ALTMANN, 1980). The effect is probably due to the presence of the infant: no difference in interest appeared in the study between infants and female carrying infants (indicating that number of individuals in the photographs was not the determining factor). The attractiveness of infants may be attributed to physical characteristics such as skin coloration (see, e.g., ALLEY, 1980, and HIGLEY et al., 1987). Note, however, that, here, most of the photographs projected represented species other than stumptails; this may account for our failure to demonstrate a difference of interest between infant and juvenile individuals.

With respect to the second result, previous authors have demonstrated that macaques are able to discriminate visually between different species of macaque (SACKETT, 1970; SWARTZ, 1983; YOSHIKUBO, 1985). In long-tailed macaques, infants appeared to prefer slides displaying stumptailed macaques to slides of their own species (SWARTZ, 1980), the author suggested that this attractiveness of stumptailed macaques might be due to their brightly pigmented face. In the present study, subjects showed longer viewing times towards their own species. It is unlikely, however, that the reason was pigmentation because other species represented on slides also displayed highly colored faces (e.g., black for *Macaca tonkeana*, red for *M. fuscata*). In other experiments using urine as an olfactory stimulus, stumptailed subjects also appeared to prefer their own species to others (DEMARIA & ROEDER, in prep.).

No obvious effects of age or gender in the photographs were found. Whether subjects differentiate between them or have different motives to look at them cannot be assessed using such a parameter. Limits of the method was clearly demonstrated by the results of the following experiment (DEMARIA, 1986). Subjects were presented either slides of individuals belonging to their group, or slides of unknown stumptailed macaques. No difference between the two categories appeared using the parameter of viewing duration. However, when sighting a familiar individual on the photograph, some subjects turned back to look towards the group. This pattern never appeared with unknown individuals, the difference between categories being statistically significant.

Regarding photographs of non-primate vertebrates, subjects responded differently between various kinds of animals but the effect was mainly due to a strong preference for watching slides of felids. A further analysis revealed that the high interest towards felids was caused in part by their two frontal and conspicuous eyes. This is not surprising in view of the importance of eye and glance in primate communication. Human newborns, for instance, direct their attention more to eye-like stimuli (FANTZ, 1966), and infant rhesus macaques preferentially direct their looks towards eyes when photographs of macaques are presented to them (MENDELSON, 1982).

However, the influence of eyes is insufficient to fully explain why felids are looked at longer than other animals presented. Responses of subjects are probably determined by other factors too. In squirrel monkeys (*Saimiri sciureus*), for example, HERZOG and HOPF (1986) have found that moving black spots analogous to those of a feline predators' fur elicited alarms appropriate to terrestrial predators; the meaning of such visual stimuli was probably learned by association. Other such "releasing stimuli," innate or learned, remain to be identified.

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