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Visiting in Perodicticus

Abstract. *Three* Perodicticus potto *have been observed in captivity for about 1 year. The social custom of visiting was established when one isolated himself from the others by living in a hollow tree trunk. The existence of such very marked social ceremonial in the Lorisoidea is of considerable evolutionary interest.*

Certain behavior patterns have been observed among three *Perodicticus potto*, kept in captivity for a period of roughly 4 years, that are so consistent they give the impression of being characteristic; hence it would be interesting if similar patterns were noticed under field conditions. These observations were made during the past year.

The pottos are maintained in a walk-in wire cage, 3.5 by 1.2 meters, 2 meters high. The floor of the cage is covered with cedar chips and sawdust. There are wooden (pine) shelves around the middle portions of the walls, and rafters for climbing are affixed to the ceiling. The cage also contains a large hollow red maple trunk, roughly 45 cm in diameter, open at both ends with a shelf and a small window built in the middle. Above the shelf, a 4-cm dowel transects the area. The bottom of the trunk, beneath the shelf, is covered with cedar chips and sawdust.

The pottos are fed nightly a diet of bananas, a protein meal (consisting of high protein pablum, methiscol, and meritene mixed with water) and water. The diet is frequently varied by the occasional additions of a variety of insects, baby mice, peanuts, persimmons, papaya juice and solids, oranges, apples, apricots, and grapes. An attempt is made to keep the environment emotionally peaceful.

The shelves of the cage are scrubbed daily with soap and water and the sawdust and chips on the floor are replaced monthly and cleaned daily. The animals appear to be in excellent condition and, with the exception of respiratory infections apparent on arrival, no disease has been prevalent.

Initially there were four animals, two males and two females. One female died as a result of pregnancy initiated elsewhere. As a consequence of her death, her male, the "beta" of the two males, decided to seclude himself on the dowel in the trunk of the tree. He came out of his "jail" (he is called M. Genet) only in the late hours of the night to eat. Initially, this determined isolation of his choice made him rather thin and as a result a shelf was placed in the trunk so that he could be fed without his having to leave his house. Once fed, he was not inclined to leave his "jail." When this pattern of behavior had been established the other male initiated a stable relationship by visiting him in his house. The pottos get an "apéritif" around five in the afternoon consisting of a half a banana each. The "alpha" male eats his banana, takes a walk, and visits the *P. potto* in the trunk, situating himself in such a way on the dowel that the two animals are face to face (Fig. 1). Sometimes the lone female also consents to visit and places herself on the shelf below. This situation persists for about 2 hours at which point the two visitors leave the trunk to eat, play, and sleep again—M. Genet remaining alone in the trunk. It occurs now practically every day.

It is interesting that the alpha male initiates the visiting. When the four animals first arrived, they were shipped in boxes, two in a box with a partition separating them and doors on either end. The screws were removed and the four doors were opened simultaneously. The alpha male potto immediately came out of his box and examined the entire cage. The other three animals remained in their sections and did not leave until after the alpha potto had visited each one when he had finished investigating.

The occurrence of such clearly marked social behavior in the Lorisoidea may be of some evolutionary significance. It would be interesting to know whether comparable behavior in these arboreal and nocturnal animals occurs

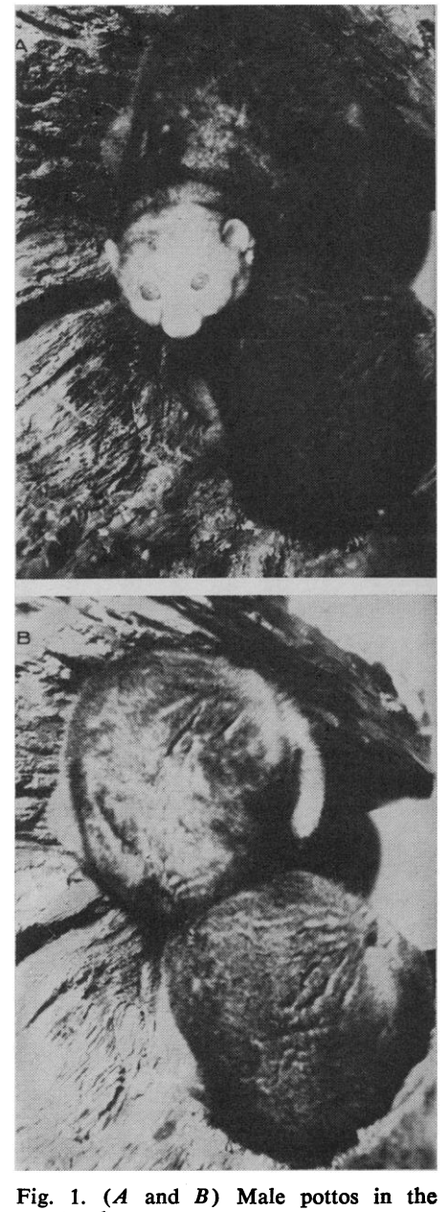

Fig. 1. (*A* and *B*) Male pottos in the tree trunk.

in their natural surroundings. Considerable experience with *P. potto* does not substantiate the reputation for ferocity that the species has apparently gained.

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Note

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Responses of Single Cells in Visual System to Shifts in the Wavelength of Light

Abstract. *Spectrally opponent cells of the macaque lateral geniculate are very sensitive to shifts from one wavelength to another, independent of the relative intensities of the different wavelengths. Shifts in opposite spectral directions from the adaptation wavelength produce opposite changes in firing rate, regardless of the particular wavelengths involved; however, any given cell is more sensitive to shifts in some spectral regions than in others.*

A person with normal vision can distinguish between two different lights on the basis of differences in intensity or wavelength. We are attempting to determine the neural organization underlying this ability by examining in the monkey the responses of single cells in the lateral geniculate nucleus (LGN), the relay station between the retina and the visual cortex.

We reported previously that two classes of cells can be distinguished in the primate LGN on the basis of their responses to stimulation of the eye by flashes of diffuse light of different wavelengths: (i) spectrally non-opponent cells, which are inhibited by light of all wavelengths, or excited by all wavelengths; and (ii) spectrally opponent cells, which are excited by some wavelengths and inhibited by others. These response differences have led us to hypothesize that the opponent cells constitute the system for analyzing and conveying information about color vision, and that the non-opponent cells constitute the brightness signalling system. Furthermore, it was predicted on the basis of certain assumptions (*1*) that the opponent cells should not only be able by their responses to distinguish between different wavelengths, but should do so better in some parts of the spectrum than in others, exhibiting the same differential sensitivity that is seen in the psychophysical hue discrimination function. In the experiments reported here, we tested these theories by examining directly the responses of LGN cells to momentary shifts in the intensity or wavelength of light presented to the eye.

The recordings were made from macaque monkeys, animals which our behavioral tests indicate have the same relative spectral sensitivity and the same color vision as normal human observers. Single cells in the LGN were isolated with microelectrodes. The oscilloscopic display of the nerve discharge was photographed on moving film and the number of spikes in the various stimulus intervals counted.

The optical system had two beams of light, one from a monochromator and the other from a tungsten source, brought to a common focus at right angles. A mirror located on a shutter arm at this focal point allowed us to reflect one or the other beam to the animal's eye. The eye was adapted to a standard light of a certain wavelength and intensity. Then the mirror was repeatedly switched to present alternately the standard light and a test light of a different wavelength or intensity. The ability of the cells to detect a change in the wavelength of the light was tested around eight spectral points: 464, 490, 528, 555, 570, 593, 622, 656 mμ. At each spectral point the responses to wavelength shifts of various amounts in both spectral directions were recorded. For instance, the responses to a shift back and forth between 593 and 580 mμ would be recorded, then between 593 and 600 mμ, 593 and 570, 593 and 590, 593 and 620 mμ, and so on. The responses of the same cell to wavelength shifts around 490 mμ might then be studied. We have examined the responses of a total of 58 LGN cells to shifts in wavelength.

Lights of different wavelengths differ in hue and brightness; if one is concerned with investigating hue discrimination, the lights should be equated for brightness—that is, adjusted on the basis of the photopic luminosity curve, as was done in these studies. The luminance of the various lights was 6.2 candela per square meter; this is well within the photopic range. In addition to the equal-brightness shifts, we have investigated shifts to wavelengths which are brighter than the standard wavelength, and to those which are dimmer. It should also be noted that with the exception of the 464-, 622-, and 656-mμ filters, the points studied were on the relatively flat part of the luminosity curve and very little correction for luminosity was required over the spectral range studied for any filter. In the intensity-shift experiments the wavelength of the light was kept constant, or more commonly, white light was used.

Non-opponent cells are extremely sensitive to shifts in intensity, increments and decrements in intensity from the adaptation level producing symmetrical changes in firing rate in opposite directions (*2*). Such cells, however, are quite insensitive to shifts in wavelength when the standard and test wavelengths are of equal brightness.

Opponent cells, on the other hand, are in general very sensitive to a shift in the wavelength, while being relatively insensitive to a change in the intensity of the light. When adapted to a light of any wavelength these cells have a maintained firing rate which is only slightly related to the wavelength. They respond with an increase in firing rate to a wavelength shift in one spectral direction from the adaptation wavelength, and with a decrease in firing to a shift in the opposite spectral direction. The red-excitatory, green-inhibitory (+R−G) cells and the yellow-excitatory, blue-inhibitory (+Y−B) cells show an increase in firing in response to a shift toward the longer wavelengths, and a decrease in firing in response to a shift toward the shorter wavelengths. The +G−R and +B−Y cells do just the opposite. An example of this can be seen in the records in Fig. 1.

This +G−R cell can be seen to discriminate clearly the 20- to 30-mμ shifts from 593 to 570, or from 593 to 620; even the 7- to 8-mμ shifts from 593 to 585 and 593 to 600 produce easily discernable changes in firing rate. When the 570- and 593-mμ lights are being alternated, the cell is fired by the 570- and inhibited by the 593-mμ light; when the shift is between 593 and 620 the cell is fired by the 593- and inhibited by the 620-mμ light. It is apparent that shifts in opposite spectral directions produce