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FERRETS MAY LEARN AWARENESS IF THEIR OWN BODY LIMITS

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Abstract

The study of the ability of self-awareness (self-awareness, the ability to perceive one's own body and mental properties separately from objects of the external world) in animals contributes to the study of the specifics of human consciousness. One of the aspects of self-awareness is body-awareness, which is expressed in the ability of an animal to take into account the physical parameters of its body when regulating behavior. We studied the ability of ferrets (*Mustela putorius furo*) to be aware of the limits of their own bodies.
To solve the experimental problem, the animals had to choose holes suitable in size for penetration in the partition that divided the sections of the experimental setup. The shapes and sizes of the holes varied. We have used both small area holes that are suitable for penetration and large areas that are not suitable for penetration. It was found that all 6 animals participating in the experiment were able to choose a hole suitable for penetration from the first trial, despite the fact that it was smaller than the unsuitable one in area. In 18 test trials, ferrets made 105 successful penetrations and 3 unsuccessful attempts. This distribution differs from the uniform one ($\chi 2 = 97.25$; $df = 2$; $p < 0.01$). None of the individuals showed a significant reduction or increase in unsuccessful attempts to penetrate the holes
This data may indicate that ferrets have knowledge of the boundaries of their bodies and the ability to compare them with the parameters of the penetration hole.

Keywords: *Self-awareness, body awareness, body limits awareness, ferrets.*

1. Introduction

Nowadays, there is a point of view that self-awareness (this sense of awareness allows animals to understand that they are different from the rest of the environment) did not arise suddenly in the course of evolution, but developed gradually (Bekoff, Sherman, 2004; De Waal, 2019; Gallup, Anderson, 2020). An important component of self-awareness is body-awareness (Dale, Plotnik, 2017).

One of the aspects of body-awareness is the ability to take into account the limits of one's own body (Khvatov et al., 2019). In a series of experiments the animals solved the problem that required correlating the boundaries of their body with the size of the holes to penetrate into the goal compartment. In dogs, it was shown that when the size of the holes decreased during the experiment, this led to the fact that the animals spent more time deciding to penetrate. When the size of the holes became too small, the dogs completely stopped trying to penetrate (Lenkei et al., 2020). A similar study was conducted on children aged 18 to 24 months (Brownell et al., 2017). The authors used several techniques to study the children's awareness of their bodies. On average, children of different ages made 2.5 mistakes while solving these problems. Since 2004 we have been studying body-awareness in various animal species - including rats (Khvatov et al., 2016) and snakes (Khvatov et al., 2019).

The aim of the current study was to determine the ability of ferrets to take into account their own body limits when penetrating holes in external objects.

2. Methods

Experimental animals: 6 male ferrets (*Mustela putorius furo*) at the age of 1 - 1.5 years. Naive animals raised in the nursery.

Equipment. The experimental setup was a rectangular arena (110x130 cm), divided in the middle by a partition with three holes. The presence / absence of holes and their size was adjusted by inserting

additional plates into the grooves on their sides. In two opposite walls of the arena there were holes (40x40 cm), to which the “start” and “finish” cages (each 40x40x45 cm) were placed.

At the beginning of each test, a ferret was placed in the “starting” cage, and a feeder with 3 pieces of dry delicacy was placed in the “finishing” cage. The experimenter went into the next room, closed the door behind him and remotely opened the door leading to the arena. We carried out 6-9 trials per day with each animal. To find out which holes ferrets prefer, we ran 2 tests with them.

3. Test 1

This test was performed to determine whether ferrets have a preference for penetrating a larger hole.

Before the test, we ran a training series to get the animals accustomed to the experimental setup and task. The series consisted of 9 trials, only one hole was opened in each trial; its location was changed quasi-randomly. The hole had a maximum size (30x30 cm).

The test consisted of 36 trials, each with all three holes were opened& Holes were suitable for penetration, but differed in diameter. We used holes with three diameters: 70 mm, 90 mm, 110 mm. The location of the holes in each trial was changed randomly. Penetrations into holes were counted during the test. For penetration, we considered such a situation when the animal completely left compartment No. 1 through one of the holes.

3.1. Results of test 1

In 36 trials, ferrets made 72 penetrations into holes with a diameter of 70 mm, 74 - into holes with a diameter of 90 mm, 70 - into holes with a diameter of 110 mm. This distribution does not differ from the uniform one ($\chi 2 = 0.056$; df = 2; p> 0.05). Also, the empirical penetration distributions for each of the 6 trorets do not differ from the uniform one (see Table 1).

Table 1. Text Evaluating preference for a larger hole in test 1.

Animal	*∅ 70 mm*	*∅ 90 mm*	*∅ 110 mm*	*X2 value by comparing empirical distribution with uniform (df=2)*
№ 1	*11*	*12*	*13*	$\chi^2=0,083; p>0.05$
№ 2	*14*	*12*	*10*	$\chi^2=0,336; p>0.05$
№ 3	*12*	*12*	*12*	$\chi^2=0; p>0.05$
№ 4	*11*	*13*	*12*	$\chi^2=0,083; p>0.05$
№ 5	*11*	*14*	*11*	$\chi^2=0,241; p>0.05$
№ 6	*13*	*11*	*12*	$\chi^2=0,083; p>0.05$
Sum	*72*	*74*	*70*	$\chi^2=0,056; p>0.05$

4. Test 2

This test was conducted to determine if ferrets would prefer smaller openings for penetration rather than large, impermeable openings. The test consisted of 54 trials, in each of which all three holes were open. In this test, two types of trials were alternated: test trials and background trials. Each test trials followed by two background ones. This sequence helped to avoid the learning effect of penetrating a certain type of holes.

In each of the 18 test trials, one of the holes (70 mm in diameter) was passable and the other two had a large area but were too narrow or too low to pass through. There were used 3 types of holes unsuitable for penetration: horizontal rectangle 250x25 mm, vertical rectangle 25x250 mm, cross (consisted of crossed horizontal and vertical rectangles).

In 36 background trials, two holes were passable and one was impermeable. In 18 trials we used horizontal rectangles 250x70, in the other 18 trials we used vertical rectangles 70x250. The impermeable hole was a circle with a diameter of 30 mm. The location of the holes in the trials was changed by accident.

During the test, we counted the number of penetrations and unsuccessful attempts to penetrate the holes. As an unsuccessful attempt to penetrate, we considered the situation when the ferret pressed against the hole, making either reciprocating movements with its muzzle in the direction of compartment 2, or skidding movements with its paws on the floor.

4.1. Results of test 2

In 18 test trials, ferrets made 105 successful penetrations and 3 unsuccessful attempts. This distribution differs from the uniform one ($\chi 2$ = 97.25; df = 2; p <0.01). Also, the empirical penetration distributions for each of the 6 ferrets separately differ from the uniform one (see Table 2).

It is important to note that none of the individuals showed a significant reduction or increase in unsuccessful attempts to penetrate the holes.

Table 2. The number of penetrations into holes of various diameters in 6 animals in test trials in test 2.

Animal	*Permeable*	*Impermeable*	*X2 value by comparing empirical distribution with uniform (df=2)*
№ 1	*17*	*1*	χ^2*=14,57; p<0.01*
№ 2	*18*	*0*	χ^2*=18,00; p<0.01*
№ 3	*18*	*0*	χ^2*=18,00; p<0.01*
№ 4	*18*	*0*	χ^2*=18,00; p<0.01*
№ 5	*16*	*2*	χ^2*=11,69; p<0.01*
№ 6	*18*	*0*	χ^2*=18,00; p<0.01*
Sum	*105*	*3*	χ^2*=97,25; p<0.01*

5. Discussion & conclusions

During the experiment, it was found that ferrets do not have a preference for penetration into large holes, since the empirical distributions of penetrations into holes of various diameters (for all 6 animals) do not differ from the uniform ones.

In the second test, it was found that in the test trials, regardless of the area of the holes, the ferrets significantly more often penetrated those of them that corresponded in size to their bodies. In addition, the number of unsuccessful attempts in all animals from the very first trial was low and did not change during the experiment. This indicates that these animals have knowledge of the limits of their bodies (one of the aspects of the body-awareness), comparing these limits with the size of the holes through which they need to penetrate.

Unlike snakes (Khvatov et al., 2019), ferrets chose suitable holes from the very first trials of the second test, which indicates that they developed this component of body-awareness in themselves early in ontogeny. It is also curious that when solving similar problems, ferrets, like rats (Khvatov et al., 2016), made fewer mistakes than children (Brownell et al., 2017).

Our data indicates this direction of research as promising for organizing experiments on other animal species.

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