QUANTITATIVE ANALYSIS OF MEMORY AND LEARNING BY RATS BY MEANS OF DIRECT TESTING

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Experiments were performed on white rats using the modified method of delayed reaction [3]. Objective of the study was to pick out of animal behaviour those algorithms, which facilitate obtaining of food in delayed response. To achieve that, we divided animal behaviour into two groups: 1. chaotic algorithms in which the knowledge of environment is not shown; 2. optimum algorithm in which the effect of learning of food obtaining manifests, the animal finds food quickly. Therefore, it became possible to estimate maximum of delayed response in both groups.

Food was provided according to the time-spatial program, in conditions of fixed constant delay for each feeding rack and constant interval of food delivery throughout the whole experiment. This program minimizes subjective interference of researcher in the test and enables to study statistics of delayed reaction formation in similar conditions.

Experiments were performed in T-shape labyrinth (Figure 1). Ten tests were performed daily, each test consisting of two phases. The first - delayed reaction during which animal was allowed to move between the feeding racks twice, the second - delayed reaction, during which movement between the racks was restricted. In case of incorrect reaction, when the rack was selected wrongly, the rat returned to the starting compartment without food and the next test started. In delayed reaction it is obligatory to provide food in one of the feeding racks. All reactions must be recorded. Record 1 means that the rat performs the action within 5 seconds time; "0" means that researches had interfered in the test. In selection of feeding racks "1" means that the animal selects the rack where it has got food previously, "0" - stands for the mistake. As a result, the record represents sequence of "0" and "1", which enables to characterize animals behaviour and identify algorithm of perception according to Baruga-Rid and Rozenblatt principle [1,2]. Method of numerical presentation of delayed behaviour representing the algorithm is given in Figure 2.

Direct delayed reaction method enables to identify maximum delay and to study perception process, as well as pick out optimum algorithm by means of which the animal makes minimum mistakes and maximally obtains the food

(Figure 3). Dynamics of delayed reaction algorithm is given in Table 1.

Table 1. Dynamics of delayed reaction algorithm – testing of delayed reaction by means of direct method

test	days									
	1	2	3	4	5	6	7	8	9	10
1	00000	11000	11000	11000	11001	11000	11111	11100	11110	11001
2	01000	10100	11000	10100	11000	11001	11001	11101	11001	10101
3	10010	11110	10100	11111	11001	11101	11001	10101	10111	10101
4	10010	11000	10100	11001	11001	11000	11000	11000	11001	10101
5	11000	11000	11001	10101	11001	11000	11000	11001	11001	11101
6	10100	11110	11110	11001	11001	11000	11000	11001	11111	11101
7	10100	10110	11000	11000	11001	10100	10100	10101	11001	10101
8	11000	11000	11100	11101	11001	10101	10101	11001	11001	10101
9	11000	11000	10100	11001	10101	11001	11001	11001	10101	11001
10	11000	11100	11101	11000	11001	11000	10100	11000	10101	11001

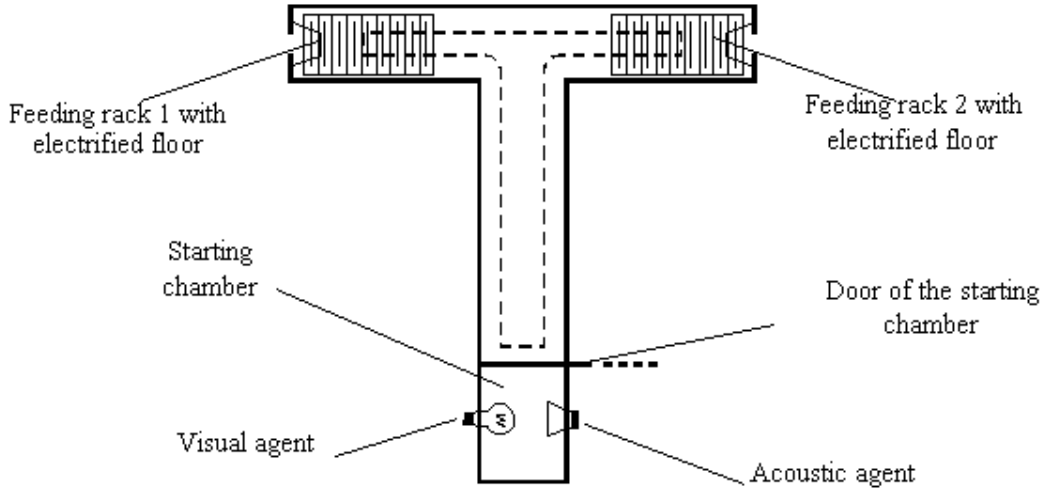

Figure 1. T-shape labyrinth

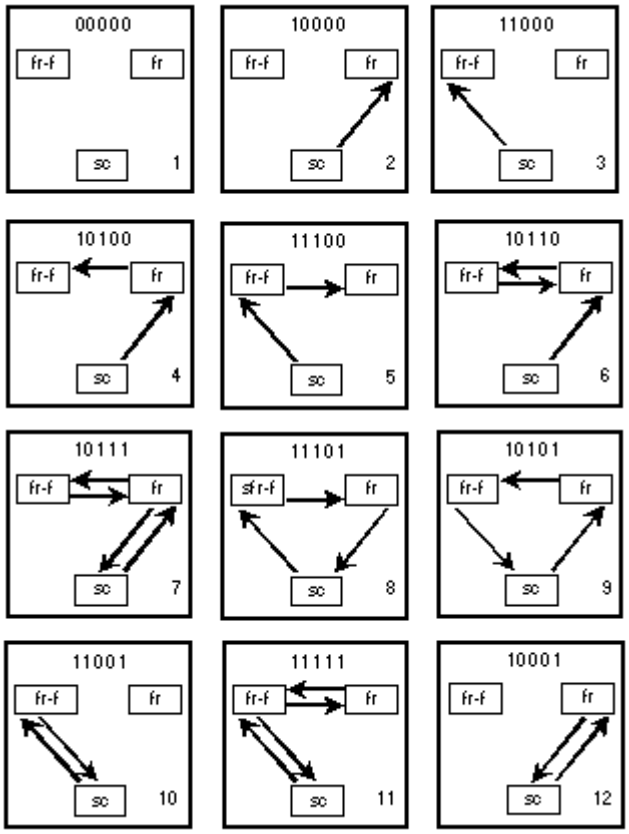

Figure 2. Recording of delayed reaction algorithm in condition of two feeding racks

sc -staring chamber; fr_f- feeding rack with food; fr-feeding rack without food

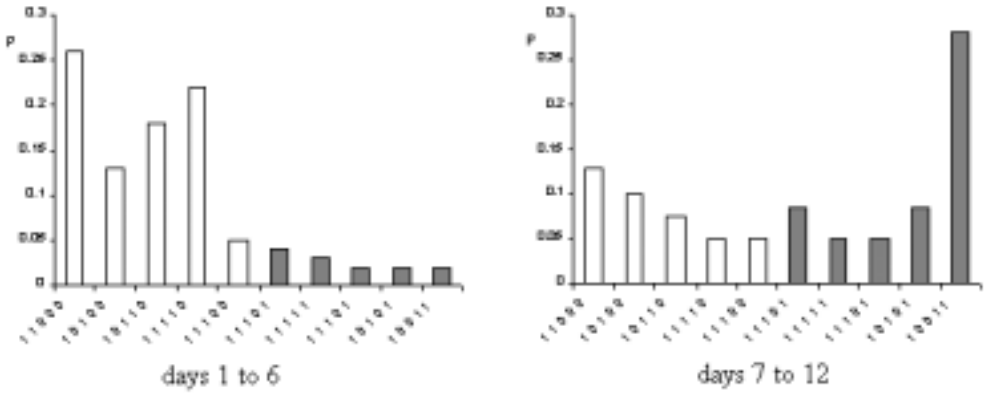

Figure 3. Frequencies of different algorithms of delayed reaction in obtaining food. Black columns - stand for optimum, white - for chaotic algorithms

Analysis of experimental data show that the animals adapt to environment. Frequency for the optimum algorithm occurrence finally increases. If during

the first six days the frequency of chaotic algorithm prevails, during the next 6 days the picture changes and frequency of optimum algorithm is predominating (Figure 4).

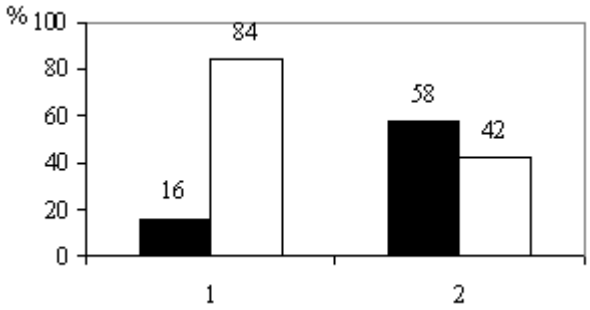

Figure 4. Chaotic and optimum algorithm realization.
1 - days 1 to 6; 2 - days 7 to 12.
White colour indicates chaotic, black colour - optimum algorithms.

Such variation of the frequency of behaviour realization algorithm testifies that the animals, based on learning, show adaptation behaviour. Suggested method enables to provide quantitative description of learning and identify maximum duration of the short-term memory. For animals with optimum algorithm, maximum delay is 35-40 sec, whereas in case of chaotic algorithm this value totals 15-20 sec.

It is interesting to measure self-descriptiveness of the image formation in rats in delayed reaction, when the animal is returned to the starting chamber to provide delay. Self-descriptiveness of an image means behaviour of the animal: 1. reaching empty feeding rack and getting back to the starting chamber; 2. returning from the feeding rack with food to the staring chamber, passing through the empty rack compartment. Since the samples were divided into collateral and consecutive (the sample is collateral when food is places in the same rack as during the previous sample, while consecutive - when food is placed in another rack), food is placed in the one rack several times consecutively or in the opposite one. At the same time, it is interesting to measure, quantitatively, proactive interference in image formation process.

R e f e r e n c e s

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