

Empathy in Rats : Bottom-up or Top-down?

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Introduction

Researchers have suggested several models for the function of human brain for several years by studying the behavior of animals such as rats and finding the mechanism of their occurrence. A noteworthy behavior which can be found in rats is empathy that is they help their peers in case of difficulty. In fact, we intended to know whether helping peers was only based on a automatic simple bottom-up processing or higher order processing also have some function in this matter. In lower order processing, seeing a peer in danger result in activation of mirror neurons. Therefore, rat sense a discomfort which relieve by doing an action. A simple conditioning mechanisms can cause then emphatic behavior. On the contrary, a higher order processing can be shown if the rat takes into account other cognitive information and make a decision. In a fair behavior, the rat pays attention to the amount of work and authority and if it is responsible for doing something to collect reward for itself and the peer, it choose to get more reward for itself. This study investigated the ratio of involvement in every two above mentioned factors based on Skinner's experiment.

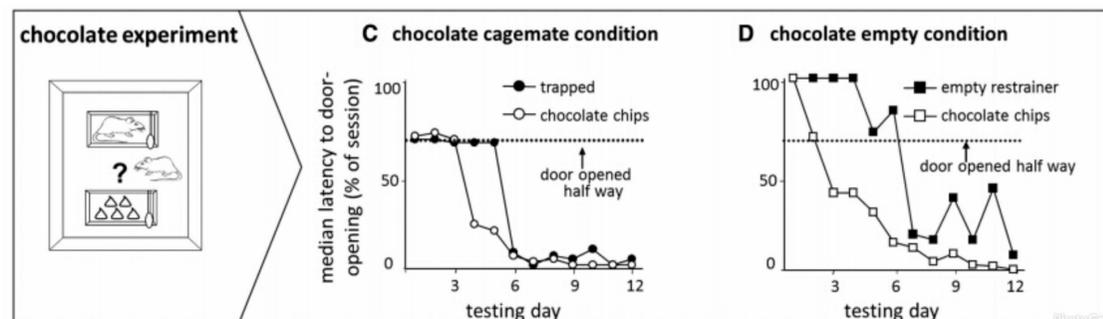
Methods (phase 1)

This study was done on 6 rats (3 males and 3 females) with pre-sexual intercourse. Training phase continued for 14 consecutive days. Rats (whit no mate) were placed to a plus maze every day to screen for 60 min. The middle transparent wall of the maze was divided into two parts and after 1 min, rats were permitted to move and adapt themselves to the new environment. They were placed at a crossroads to choose the lever. At the end of the training phase, each of them was able to receive one pellet by pressing the lever 1; one pellet for itself and one for the cage mate by pressing lever 2. All six rats underwent 14 training sessions in the morning and evening and took some rest at the end of two weeks for 4 days; then the pellets were removed since the third day and only water was given to them.

Phase 2

Experiment phase took for 3 days with 10-min trials. During the experiment, both rats, after 1 min adapting to the new environment, permitted to move. Then the first time of pressing lever as the reaction time was measured by a controller rat and the number of pressing lever. Totally, 36 experiments were performed as male/male and female/female tests, and each rat was a controller in the morning and evening for 6 times and vice versa. In the experiment phase, rats were allowed to feed only when they were in the maze and during their 10-min experiments and they could drink water when they were in their cages.

1 Rats opened the door for a trapped cagemate



Inbal Ben-Ami Bartal, Jean Decety .Empathy and Pro-Social Behavior in Rats .Science 09 Dec 2011: Vol. 334, Issue 6061, pp. 1427-1430

2 Pre-experimental training

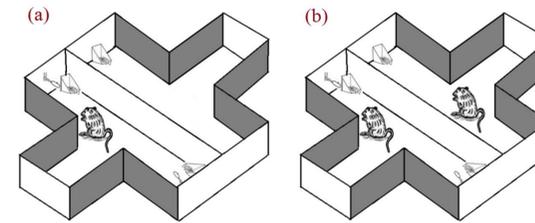


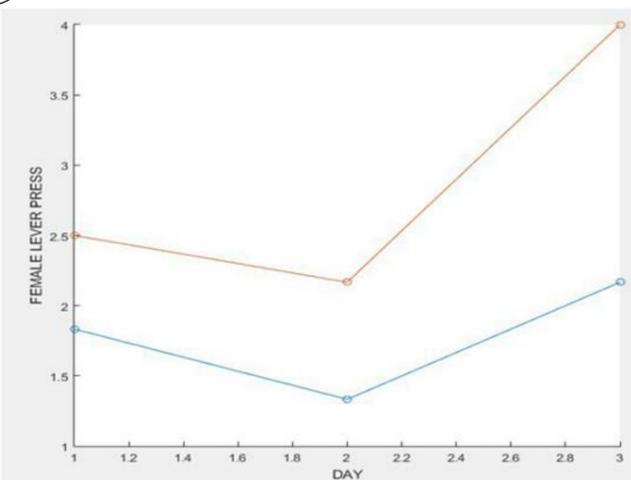
Figure 1.

(a)The controller rat learned to press the levers to provide food (left)

(b) Experiment : the first time of pressing lever as the reaction time was measured by a controller rat and the number of pressing each lever over the course of 10 min.

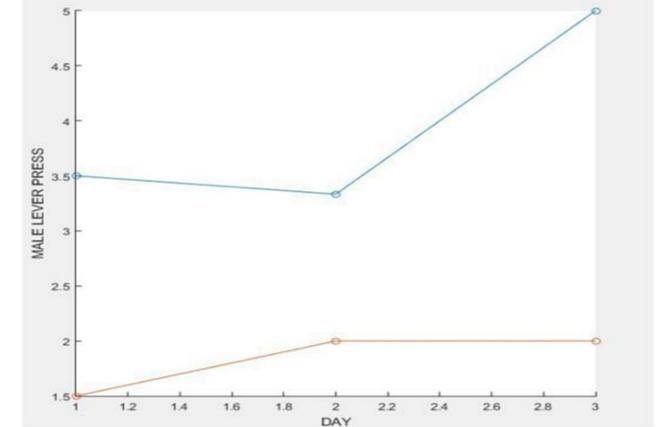


3 female lever press-day



Red diagram :lever 2 (feeds both rats)
Blue one : lever 1 (feeds only the controller)

4 male lever press-day



Red diagram :lever 2 (feeds both rats)
Blue one : lever 1 (feeds only the controller)

Analysis and Conclusions

Based on this hypothesis, if the ratio of pressing lever 1 is more than that of lever 2,the emotional contagion will play a major role in decision-making while if the ratio is reversed,the rational behavior will be more important. Therefore, based on the data collected during the experiments,two diagrams of female lever press-day and male lever press-day were drawn. By studying the four diagrams and their slopes, it was found thatthe emotional contagion among thefemale ratsplays a major role in decision-making while for male-rats, dependent on the intended conditions, rational choice is dominant.

Refrences

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