Video Article

The Structure of Skilled Forelimb Reaching in the Rat: A Movement Rating Scale

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Abstract

Skilled reaching for food is an evolutionary ancient act and is displayed by many animal species, including those in the sister clades of rodents and primates. The video describes a test situation that allows filming of repeated acts of reaching for food by the rat that has been mildly food deprived. A rat is trained to reach through a slot in a holding box for food pellet that it grasps and then places in its mouth for eating. Reaching is accomplished in the main by proximally driven movements of the limb but distal limb movements are used for pronating the paw, grasping the food, and releasing the food into the mouth. Each reach is divided into at least 10 movements of the forelimb and the reaching act is facilitated by postural adjustments. Each of the movements is described and examples of the movements are given from a number of viewing perspectives. By rating each movement element on a 3-point scale, the reach can be quantified. A number of studies have demonstrated that the movement elements are altered by motor system damage, including damage to the motor cortex, basal ganglia, brainstem, and spinal cord. The movements are also altered in neurological conditions that can be modeled in the rat, including Parkinson's disease and Huntington's disease. Thus, the rating scale is useful for quantifying motor impairments and the effectiveness of neural restoration and rehabilitation. Because the reaching act for the rat is very similar to that displayed by humans and nonhuman primates, the scale can be used for comparative purposes. from a number of viewing perspectives. By rating each movement element on a 3-point scale, the reach can be quantified. A number of studies have demonstrated that the movement elements are altered by motor system damage, including damage to the motor cortex, basal ganglia, brainstem, and spinal cord. The movements are also altered in neurological conditions that can be modeled in the rat, including Parkinson's disease and Huntington's disease. Thus, the rating scale is useful for quantifying motor impairments and the effectiveness of neural restoration and rehabilitation.

Experiments on animals were performed in accordance with the guidelines and regulations set forth by the University of Lethbridge Animal Care Committee in accordance with the regulations of the Canadian Council on Animal Care.

Video Link

The video component of this article can be found at http://www.jove.com/video/816/

Protocol

The experiment involves training rats to reach for food and then filming the movements used for reaching.

1. Long Evans laboratory rats are mildly deprived of food for 10 days, then adapted to a box containing a slot through which they can reach for food pellets.
2. After about 10 days of training the rats reach consistently and display a preference of one paw.
3. The reaching act is filmed using a high shutter speed (1,000 f/sec) and fiming is done from a number of perspectives.
4. The reaching act is then replayed using frame by frame replay.
5. The movements are described in the accompanying video.

Discussion

Previous studies of limb use in the rat have characterized the movement in terms of end points, success or failure, or in terms of a Cartesian trajectory of the paw toward the target. The present study describes the movement in terms of relations between limb segments, other body parts and the target.

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References

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