

Rodent Staircases - Skilled paw reaching for both the rat and the mouse

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Introduction

The Montoya Staircase test was originally designed at the University of Cambridge, Department of Experimental Psychology in 1989. Since that time there have been many positive and encouraging international peer-based reviews. The Staircase test has been used in over 50 labs worldwide and cited in over 1000 international peer reviewed publications, books, articles, and industrial reviews.

The Staircase Test was first introduced globally by Montoya, Astell, & Dunnett 1990¹. The technical schematics for the Staircase test came out a year later².

Over 3 decades the Montoya Staircase Test has been, evaluated, upgraded and modified demonstrating its flexibility and continued scientific utility. Whishaw et al. in 1997³ concluded, "The results confirm that the Staircase Test is a sensitive measure for motor system damage and demonstrates that when movement analysis is combined with end point measures, the test

can dissociate impairment, recovery, and compensation."

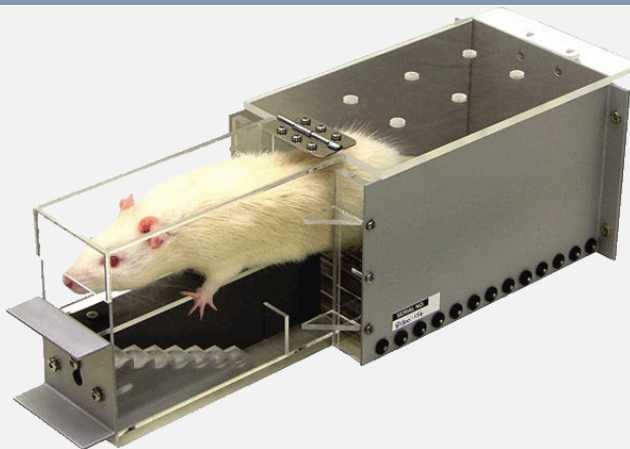
The Staircase test is also adaptable in rather novel ways. Kloth et al. 2006⁴ used color-coded pellets that increased the sensitivity of the Staircase test to differentiate skilled forelimb performance between control and 6-hydroxydopamine lesioned animals.

The Montoya Staircase Test has also been positively reviewed in several books and encyclopedias^{5,6,7}.

More recent sampling of international peer reviews in books include: Molecular Pharmacology and Pathology of Strokes 2019⁸; Animal Models of Acute Neurological Injury⁹ (page 456); Environmental Enrichment: and Enhancing Neural Plasticity, Resilience, and Repair¹⁰ (2019; page 153).

Recent international peer reviewed articles include areas spanning the range from progenitor cells, infinity spinal cord contusions, transgenic manipulations, and

Product Focus: 80300/301 Rodent Staircase



This staircase apparatus provides a simple, efficient, and easy way to quantify the testing of skilled paw reaching for the rat.

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transplantation in a hyaluronan-based hydrogel among others^{11,12,13,14}. In conclusion, and in my opinion, the Staircase test has proven itself to have reached the Gold Standard in behavioural research.

Procedures

(extracted and edited from Jager LD et al 2017, [Comparing Staircase and Skilled Forelimb Reaching Tests After Endothelin1-Induced Stroke](#). *J Neurol Neuro Sci Disord* 3(1): 016-022)

Skilled reaching tasks

Rats are trained to reach for food rewards such as mini-chocolate or sugar pellets, in the Montoya Staircase Box. Animals were habituated to the food rewards by placing a sample of each in their home cages daily for 5 days prior to the onset of training. Training lasted 2 weeks and was performed 5 days/week, 10 minutes/day. Beginning 3 days before training, all rats were placed on a restricted diet (maintaining no less than 85% free-feed bodyweight) to increase motivation to perform behavioral tests. Separate food rewards were chosen for each task also for this reason. They stayed on this restricted diet for the remainder of the study, with the exception of the day of the surgical procedure when they were free-fed overnight. Testing lasted 2 weeks prior to stroke induction and was performed 5 days/week. Rats were then tested again 7 days after the stroke. Raters were blinded to which group the rats belonged.

Training-staircase

Rats were placed in a modified Montoya Staircase Box constructed of clear acrylic for 10 minutes per session. The rat rests on a central elevated counter in the narrow forward chamber with eight steps descending on either side. Steps on the left can only be reached with the left paw and steps on the right can only be reached with the right paw, thus providing a measure of independent forelimb skilled reaching. A single mini-chocolate chip was placed on each step and re-baited as necessary to encourage participation during the session.

Testing-staircase

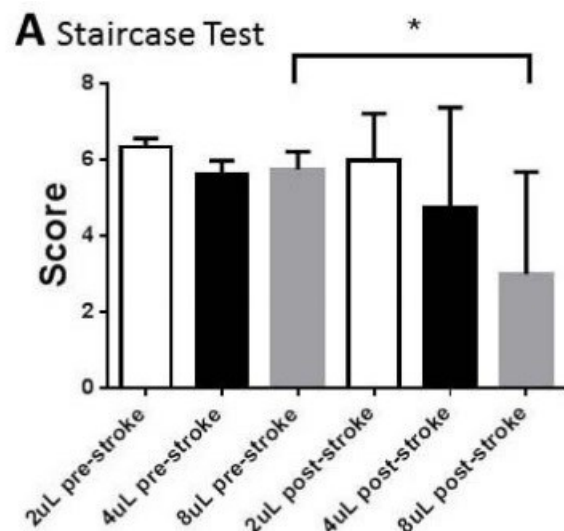
Rats were placed in the Montoya Staircase Box, each test lasting 5 minutes. A single chocolate chip was placed on each of the 8 steps per side. The number of

chocolate chips retrieved was counted. The test was repeated 3x unless the rat successfully retrieved all 8 chocolate chips on each side; the most successful trial for both the dominant and non-dominant hands was recorded and used to calculate skilled reaching ability. Data are presented as the mean number of treats successfully retrieved.

Results

Staircase test

The staircase test was able to discern differences between pre- and post-stroke behavior for rats who received the 8uL ET-1 injection, but not for rats receiving the 2 or 4uL injection (see Figure below). The mean pre-stroke score for rats receiving the 2uL injection was 6.340, while the mean post-stroke score was 6 (p=0.3723). The mean pre-stroke score for rats receiving the 4uL injection was 5.625, while the mean post-stroke score was 4.75 (p=0.2393). The mean pre-stroke score for rats receiving the 8uL injection was 5.75, while the mean post-stroke score was 3 (p<0.0001).



Conclusions

The staircase test, which can be completed and scored by an untrained observer, is considered less subject to operator bias. The staircase test has another advantage in that both arms can be tested simultaneously, allowing the investigator to select which hemisphere in which to induce the stroke, and allowing a comparison of injured and uninjured behaviors in the same animal. Thus, each animal serves as its own control

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