

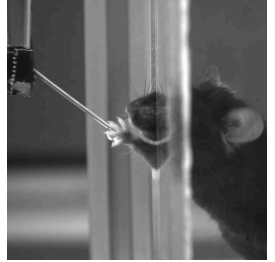
Feb 27, 2025

Version 1

Forelimb reaching-grasping task V.1

DOI

<https://dx.doi.org/10.17504/protocols.io.n2bvj9k2plk5/v1>



Alessandro Contestabile^{1,2}, Konstantinos Meletis^{1,2}

¹Department of Neuroscience, Karolinska Institutet, Stockholm, Sweden;

²Aligning Science Across Parkinson's (ASAP) Collaborative Research Network, Chevy Chase, MD 20815, United States of America



Alessandro Contestabile

Karolinska Institutet

Create & collaborate more with a free account

Edit and publish protocols, collaborate in communities, share insights through comments, and track progress with run records.

Create free account

OPEN  ACCESS



DOI: <https://dx.doi.org/10.17504/protocols.io.n2bvj9k2plk5/v1>

Protocol Citation: Alessandro Contestabile, Konstantinos Meletis 2025. Forelimb reaching-grasping task. **protocols.io**

<https://dx.doi.org/10.17504/protocols.io.n2bvj9k2plk5/v1>



Manuscript citation:

Anxa1+ dopamine neuron vulnerability defines prodromal Parkinson's disease bradykinesia and procedural motor learning impairment
Ioannis Mantas, Alessandro Contestabile, Vasiliki Skara, Camille Loiseau, Ines A Santos, Kaitlyn M
L Cramb, Roberta Filograna, Richard Wade-Martins, Peter Magill, Konstantinos Meletis
bioRxiv 2024.12.22.629963; doi: <https://doi.org/10.1101/2024.12.22.629963>

License: This is an open access protocol distributed under the terms of the **Creative Commons Attribution License**, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited

Protocol status: Working

We use this protocol and it's working

Created: February 27, 2025

Last Modified: February 27, 2025

Protocol Integer ID: 123515

Keywords: forelimb, reaching, sensory-motor learning, freely moving, grasping task, sensorimotor function in rodent model, rodent behavior, present in rodent behavior, evaluating rodent, task the forelimb, moving rodent, reaching movement, rodent model, forelimb, assessment of fine motor skill, fine motor skill, sensorimotor function, training, behavioral assay, standardized approach to training, dedicated training for successful performance, coordination, used behavioral assay, training schedule, dedicated training, task, apparatus setup

Funders Acknowledgements:

Aligning Science Across Parkinson's

Grant ID: ASAP-020370

Swiss National Science Foundation

Grant ID: P500PB_214355

Abstract

The forelimb reaching-grasping task is a widely used behavioral assay to assess sensorimotor function in rodent models. This protocol outlines a standardized approach to training and evaluating rodents in a reaching and grasping task, aiming to ensure consistency and reliability across studies. The task involves training freely moving rodents to reach through an aperture to grasp a drop of water, allowing for the assessment of fine motor skills and coordination. Notably, the reaching movement executed in this task is not naturally present in rodent behavior and requires dedicated training for successful performance. This protocol provides detailed guidelines on apparatus setup, training schedules, and data collection methods.

Guidelines

1. Animal preparation

Rodents are housed under controlled environmental conditions, including a 12-hour light/dark cycle.

Mild water restriction is applied to encourage task engagement, ensuring that each animal receives a minimum of 1 mL of water per day to maintain proper hydration and welfare.

To minimize stress and facilitate task learning, animals undergo a habituation period before training, allowing them to acclimate to both handling and the experimental apparatus.

2. Training protocol

The training regimen begins with a three-day habituation phase (15-minute sessions per day), during which the water spout is positioned flush against the chamber wall (0 cm) at a height of 5.5 cm from the floor. This initial setup allows animals to associate the spout with the water reward.

Following habituation, the spout is incrementally shifted 1 cm away from the wall while maintaining the same height. This adjustment requires the mice to extend their forelimbs to obtain the water drop, reinforcing the reaching behavior.

Once mice consistently use their forelimbs to retrieve the water reward, formal training begins. Training continues for a minimum of four consecutive days, with daily 15-minute sessions.

3. Welfare monitoring

To ensure animal welfare, daily body weight measurements must be recorded. If an animal's weight drops below 90-85% of its baseline, both water restriction and task participation should be immediately suspended to prevent excessive stress or dehydration.

Additionally, general health and behavior should be monitored to detect signs of distress or adverse effects from training.

4. Performance assessment

A trial is considered successful if the mouse extends its forelimb, makes contact with the water drop, and successfully consumes it.

Key performance metrics include:

- Success rate (*percentage of successful trials*)
- Number of reaching attempts per session
- Kinematic analysis of reaching movements

These parameters should be assessed across multiple days to evaluate sensorimotor learning and adaptation.

5. Considerations

- If a mouse exhibits side bias (consistent preference for one forelimb), access to the preferred limb can be restricted using a physical barrier near the narrow aperture on the opposite side.
- The setup allows for video recording of reaching behavior, as well as optogenetic inhibition or excitation (via opsin expression) to assess the neural mechanisms underlying forelimb control.

6. Video Analysis

Include a reference marker in the video frame (e.g., a ruler or a known-distance object) to enable conversion from pixels to centimeters for kinematic analysis.

Video analysis can be performed manually or with automated tracking tools to extract detailed kinematic parameters:

- Manual annotation can be done using software such as Kinovea, which allows frame-by-frame assessment of movement execution.
- Automated kinematic tracking can be achieved using DeepLabCut or similar deep-learning-based approaches to track body points, enabling precise movement quantification.

These analyses help to extract fine-grained motor features such as velocity, trajectory, and limb coordination, providing a more comprehensive assessment of motor function and learning.

Materials

- The task is conducted in a custom-built transparent chamber (10 × 10 cm) with a front wall containing a narrow aperture through which the rodent can reach/grasp.
- A small spout positioned just outside the aperture delivers a drop of water each 7 seconds. The spout should be adjustable to ensure proper positioning relative to the testing phase (habituation or training).
- The floor should provide stable footing to avoid postural instability during task execution.
- Mice behavior was recorded daily using a FLIX camera (60 fps, 800 × 800 px) positioned laterally to capture detailed movement kinematics.

Before start

Start water restriction at least 24 hours before the first session.

Start water restriction at least 24 hours before the first session

- 1 Determine the baseline weight of the mice through initial measurements.

Habituation phase (days 1-3)

- 2 Prepare Setup
 - Ensure the chamber is clean and free from any distractions.
 - Position the water spout flush against the chamber wall (0 cm from the wall, 5.5 cm from the floor).
 - Set up the camera in a lateral position to capture movements.
 - Include a reference marker in the video frame (e.g., a ruler or a known-distance object) to enable conversion from pixels to centimeters for kinematic analysis.
- 3 Introduce the mice into the setup
 - Gently place the mouse into the chamber to allow exploration.
 - Let the animal acclimate to the environment.
 - Ensure minimal handling to reduce stress
- 4 Start recording and water drop delivery
 - Begin continuous video recording to monitor behavior.
 - Automatically or manually dispense a water drop at the spout at regular intervals to familiarize mice with the reward location.
 - Observe and record spontaneous interactions with the spout.
 - Repeat the procedure for 15-minute sessions each day for three consecutive days.
- 5 Remove the mouse and clean the setup

Testing phase (days 4-7 or more)

- 6 Prepare Setup
 - Ensure the chamber is clean and free from any distractions.
 - Position the water spout flush against the chamber wall (1 cm from the wall, 5.5 cm from the floor).
 - Set up the camera in a lateral position to capture reaching movements.
 - Include a reference marker in the video frame (e.g., a ruler or a known-distance object) to enable conversion from pixels to centimeters for kinematic analysis.
- 7 Introduce the mice into the setup
 - Gently place the mouse into the chamber.



- Ensure minimal handling to reduce stress
- 8 Start recording and water drop delivery
 - Begin continuous video recording to monitor behavior.
 - Automatically dispense a water drop at the spout.
 - Observe and record spontaneous interactions with the spout.
 - Repeat the procedure for 15-minute sessions each day for three consecutive days.
- 9 Remove the mouse and clean the setup

Protocol references

Galiñanes, G.L., Bonardi, C., and Huber, D. (2018). Directional Reaching for Water as a Cortex-Dependent Behavioral Framework for Mice. *Cell Rep* 22, 2767–2783. <https://doi.org/10.1016/j.celrep.2018.02.042>.

Acknowledgements

This research was funded in part by Aligning Science Across Parkinson's ASAP-020370 through the Michael J. Fox Foundation for Parkinson's Research (MJFF). A.C. was supported by the Swiss National Science Foundation (P500PB_214355) and the Amicitia Foundation.