Supplementary Material 1

From imaging to precision: Low cost and accurate determination of stereotactic coordinates for brain surgery *Sapajus apella* using MRI

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1. SUPPLEMENTARY DATA

1.1 Steps for selecting the whole brain and surgical targets were as follows:

(1) Brain Volume Rendering and Calculation

MRI volume rendering was performed using the "Segment Editor" module. Brain volume was manually delineated by skull-stripping, with parts of the olfactory bulb and optic chiasms also being removed. This brain volume rendering serves as a spatial reference for MRI anatomical landmarks, which are essential for determining stereotaxic planes. Additionally, brain volume was quantified from the volume rendering in cubic millimeters (mm^3) using the "Segment Statistics" module.

(2) Anatomical Landmarks Positioning

Anatomical landmarks were identified according to MRI using the "Markups" module. Two landmarks were placed at the bilateral acoustic meatus (F1, F2), aligning with the interaural line. Another two landmarks were positioned at the bilateral infraorbital foramen (F3, F4).

(3) Stereotaxic Alignment

To simulate actual stereotaxic positioning, the alignment of the three stereotaxic planes was performed using the "Transforms" module. This alignment, based on MRI and brain volume rendering, established a new coordinate representing the stereotaxic origin.

(4) Translating Stereotaxic Origin to 3D Slicer Origin

A new transformation was created with the "Transforms" module. The inverse values of the origin coordinates were inputted in the translation box for left-right (LR), posteroanterior (AP), and inferior-superior (IS) axes to reset the 3D Slicer origin to zero.

(5) Fiducials Surgery Planning

Individual fiducial surgery planning involved eight surgical targets within the basal ganglia structures, unilateral in approach. Four fiducials were placed on the dominant motor side of the substantia nigra, with an additional four along the striatum. Each fiducial was located using the "Markups" module with specific LR, AP, and IS coordinates in millimeters.

(6) Validation

Various control fiducials were used for method validation. These included the anterior horns of the left and right sides (A1, A2), the posterior horns of the left and right sides (P1, P2), and the splenium and genu of the corpus callosum (S, G).

See the guide for processing MRI using Slicer 3D software in Supplementary Material 3

2. SUPPLEMENTARY TABLES AND FIGURES

1.1 Tables

Table 1 – Studies using *Sapajus apella* as an animal model in neuroscience over the last 20 years.

Year	Findings
2003	Cognition - 1 (McGonigle et al., 2003)
	Visual system - 1 (Jacobs and Deegan II, 2003)
	Poliovirus - 1 (Ida-Hosonuma et al., 2003)
2004	Mophorlogy - 1 (Horta-Júnior et al., 2004)
2005	Visual system - 4 (Gomes et al., 2005;Jacobs and Deegan, 2005;Saito et al., 2005a;Saito et al., 2005b)

2007	Morphophysiology - 1 (Pinato et al., 2007)
	Behaviour – 1 (Tavares et al., 2007)
	Motricity - 1 (Padberg et al., 2007)
2009	Morphophysiology -2 (Dum et al., 2009;Phillips et al., 2009)
2010	Morphophysiology -1 (Bostan et al., 2010)
2011	Visual system -1 (Ito et al., 2011)
	Pharmacology - 1 (Cavalcante et al., 2011)
	Behaviour - 2 (Brosnan et al., 2011;Fragaszy et al., 2011)
	Morphophysiology – 1 (Maior et al., 2011)
2012	Morphophisiology - 1 (Phillips and Sherwood, 2012)
2013	Morphophisiology – 1 (Aversi-Ferreira et al., 2013)
2014	Behaviour – 3 (Amici et al., 2014;Mayer et al., 2014;Saletti et al., 2014)
	Anatomy –1 (Aversi-Ferreira et al., 2014)
	Morphophisiology – 1 (Finlay et al., 2014)
2015	Morphophisiology – 3 (Borges et al., 2015;Charvet et al., 2015;Vasconcelos Braz et al., 2015)
	Pharmacology – 2 (Borges et al., 2015;Bowler et al., 2015)
2016	Cognition – 2 (Tecwyn et al., 2017;Truppa et al., 2017)
	Memory – 1 (Truppa et al., 2016)
	Morphophisiology – 4 (Hamadjida et al., 2016;Ohbayashi et al., 2016;Quessy et al., 2016;Lucarelli et al., 2017)

	Motricity – 1 (Dea et al., 2016)
2017	Visual System – 3 (Lucarelli et al., 2017;Stephenson et al., 2017;Truppa et al., 2017)
	Pharmacology – 2 (Lévesque et al., 2017;Lucarelli et al., 2017)
2018	Behaviour – 1 (Benítez et al., 2018)
2019	Behaviour – 2 (Broihanne et al., 2019;Smith et al., 2019)
2020	Cognition – 1 (Hirel et al., 2020)
	Behaviour – 2 (Heuberger et al., 2020;Trapanese et al., 2020)
	Morphophysiology – 1 (Ohbayashi, 2020)
2021	Cognition – 1 (Jordan et al., 2021)
	Morphophysiology – 1 (Hecht et al., 2021)
	Behaviour – 1 (Robinson et al., 2021)
2022	Behaviour – 2 (Roig et al., 2022;Trapanese et al., 2022)
	Mophophisiology – 2 (Lucore et al., 2022;Watson et al., 2022)
	Cognition – 2 (Miss et al., 2022;Sosnowski et al., 2022)
2023	Behaviour – 2 (Ciacci et al., 2023;Daoudi-Simison et al., 2023)
	Morphophysiology – 2 (Reilly et al., 2023;Sosnowski et al., 2023)

Table 2 – Mean and standard deviation (SD) error for anterior-posterior, dorsal-ventral, and medio-lateral axes in each animal.

ANTERIOR-POSTERIOR							
AMASA	**AMAXD**	**AMBBH**	**AMBCL**	**AMBEG**	**AMBEN**	**MEAN**	**SD**
0.0259	0.0182	0.0268	0.0107	0.0074	0.0313	0.02	0.01
DORSAL-VENTRAL							
AMASA	**AMAXD**	**AMBBH**	**AMBCL**	**AMBEG**	**AMBEN**	**MEAN**	**SD**
0.0782	0.021	0.0753	0.0239	0.0217	0.311	0.09	0.1
MEDIO-LATERAL							
AMASA	**AMAXD**	**AMBBH**	**AMBCL**	**AMBEG**	**AMBEN**	**MEAN**	**SD**
0.0107	0.012	0.0163	0.0177	0.0129	0.0087	0.013	0.003

2.2 Figures

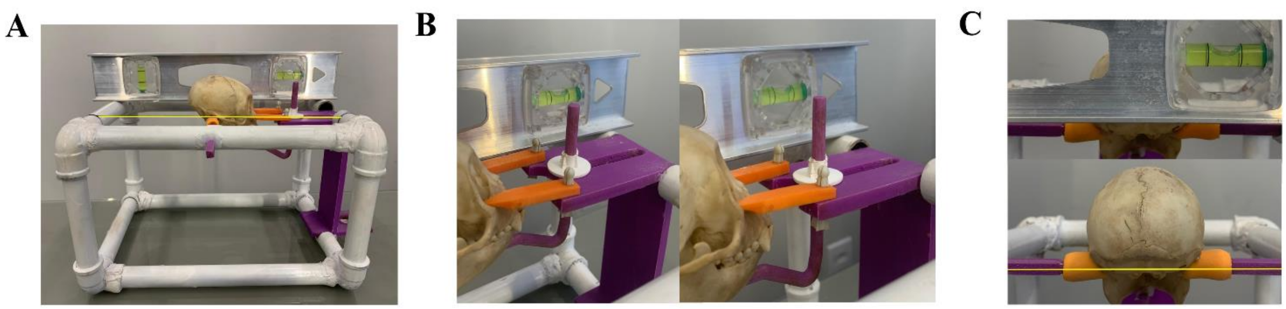

Figure S1. Demonstration of aligment to the apparatus using a measurement tools. (A) alignment of Frankfurt plane. (B) The stereotactic apparatus design allows the adjustment of the orbital and mouth adaptor moving the support system. (C) Interaural ear bars alignment.

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