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Data Article

Circle drawing and tracing dataset for evaluation of fine motor control

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A B S T R A C T

We introduce a motion dataset from healthy human subjects ($n = 125$) performing two fine motor control tasks on a graphic tablet, namely circle drawing and circle tracing. The article reports the methods and materials used to capture the motion data. The method for data acquisition is the same as the one used to investigate some aspects of fine motor control in healthy subjects in the paper by Cohen et al. (2018) “Precision in drawing and tracing tasks: Different measures for different aspects of fine motor control” (https://doi.org/10.1016/j.humov.2018.08.004) [1]. The dataset shared here contains new raw files of the two-dimensional motion data, as well information on the participants (gender, age, laterality index). These data could be instrumental for assessing other aspects of fine motor control, such as speed-accuracy tradeoff, speed-curvature power law, etc., and/or test machine learning algorithms for e.g., task classification.

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Specifications Table

Subject	Neuroscience
Specific subject area	Fine motor control, gesture recognition, classification, segmentation and evaluation
Type of data	Motion data
How data were acquired	Graphic pen tablet (Wacom Intuos®CTH-690AK, Tokyo, Japan)
Data format	Raw data (as a single .mat file and as separated csv files)
Parameters for data collection	Subject were asked to perform two fine motor control tasks. Specifically, they were instructed to execute circle drawing and circle tracing movements using the tablet's pen. Order of test was randomized.
Description of data collection	Data were collected via a graphic pen tablet. Demographic variables were recorded before the behavioral measures. Participants were instructed to employ the graphic tablet to free draw a circle or trace a circle appearing on the screen. Each testing condition (drawing and tracing) was executed once by each participant, yielding two movement for each participant, for a total of 250 movements in total. The movements were digitized at a sampling rate of ca. 50 Hz.
Data source location	Institution: University of Florence City/Town/Region: Florence Country: Italy Latitude and longitude for collected samples/data: 43°48′07.8″N 11°14′42.2″E
Data accessibility	Data is available with the article
Related research article	E. J. Cohen, R. Bravi, M. A. Bagni, and D. Minciacchi, Precision in drawing and tracing tasks: Different measures for different aspects of fine motor control, Human Movement Science 61 (2018), 177–188. doi: 10.1016/j.humov.2018.08.004.

Value of the Data

- This dataset may be useful to investigate several aspects of fine motor control, including the role of external (tracing) versus internal (drawing) cues in motor performance.
- This dataset will benefit those interested in human motor control, but also those who wish to test machine learning algorithms.
- This data may be used to make new inference on the patterns of emergence of selective features of distinct movements and how this may or may not remain constant across subjects.

1. Data Description

In this dataset we present the movement data from 125 healthy subjects (aged 23.6 ± 5 years, laterality index 70.88 ± 37.49, 114 females) performing circle drawing and circle tracing movements, acquired using the same approach as in [1]. Table 1 reports the characteristics of the study participants as well as two main metrics of movement: movement time, MT and the circle radius.

Table 1. Demographics of the participants and two main movement metrics. N:sample size. M: movement. Values represent mean ± standard deviation.

The supplementary materials consist of a .mat file, which was created using Matlab R2019b and separated csv files, as open-source data format. The .mat file contains a single structure

Table 1
Participants' demographics. Demographics of the participants and two main movement metrics. N:sample size. M: movement. Values represent mean ± standard deviation.

					MT (s)		Circle radius (cm)	
Subjects (N)	Females (N)	Age	Laterality Score	M (N)	Drawing	Tracing	Drawing	Tracing
125	114	23.6 ± 5	70.9 ± 37.5	250	15.4 ± 15.8	27.1 ± 17.3	3.39 ± 1.27	5.00 ± 0.28

entitled Subject which has 125 entries (each corresponding to a single subject). Within each Subject entry, there are two fields, corresponding to sub-structures. The first field “Info”, holds the data relative to the subject: Sex, Age, and Laterality Index (abbreviated as LL in the .mat file). The second field “Trial”, hold the data relative to the trial performed by the subject and contains two variables: “Trace” and “Draw” corresponding to the tracing and drawing of the circle, respectively. Each of the variables contain 3 columns, the first column corresponds to the total movement time, the second column correspond to x coordinates and the third to the y coordinates.

For the readers convenience, we also provide the dataset as csv files, one for each movement totalling to 250 files. Each csv file’s name contains the following meta-data information: subject ID, gender, age, laterality score, task (drawing or tracing). Each file is composed by 3 columns containing the data on the x, y coordinates of the cursor (in cm) and the time from 0 to the end of the movement (“x”,“y”, and “prog_time_draw_*sec*” or “prog_time_trace_*sec*”, respectively).

2. Experimental Design, Materials and Methods

2.1. Participants

Participants were recruited on a voluntary basis from a pool of undergraduate students. All subjects gave their informed consent prior to data collection and acquisitions, which were undertaken in compliance with the ethical principles of Helsinki Declaration and approved by the institutional expert committee. Participants were free of any documented visual, motor, and neurological impairments. All subjects reported to have a corrected-to-normal visual acuity. All subjects reported to not have any previous experience in using a graphic pen tablet (Wacom Intuos®CTH-690AK, Tokyo, Japan; active area: 216×135 mm, 2540 lpi Resolution).

Prior to their participation, subjects were assessed for laterality using the Edinburgh Handedness Inventory [2].

2.2. Set-up

The subjects seated comfortably in front of a desktop monitor, with the dominant hand holding a graphic pen used to perform the task on the tablet, which was not directly observable during the task (no visual input used from the tablet).

Each subject was asked to “draw a circle as precise as you can, meaning a circle having a constant radius” or “draw a circle as round as you can”, regardless of circle size. No information was given regarding the size of the circles to be drawn. For tracing, a template was presented to the subjects on the monitor (10 cm diameter) and subjects were asked to trace the circle is accurately as possible.

Subjects were instructed to execute drawing and tracing of a circle, without the support of either wrist, arm, or elbow, in such a way that the only contact with the tablet was made through the pen. For both drawings and tracings, subjects were further instructed to begin at 12 o’clock and continue in a counterclockwise manner.

The data corresponds to the tablet data, projection on the screen was made for having a 1 to 1 ratio between projection and tablet.

In light of the randomized order between drawing and tracing, an equal number of participants who started with either the former or the latter was obtained. Each participant underwent a one-minute pause, thus exceeding the temporal limit of working memory, before performing the other task were asked to perform the other task. Though the experimental design was similar to that published in the previous paper [1], recording of the data was different for this dataset. Specifically, for this dataset a custom software was created using python 3.6 in which data was collected in each trial. Following that, data was transferred to Matlab and was saved. The sampling rate for each movement was computed from the total time and the

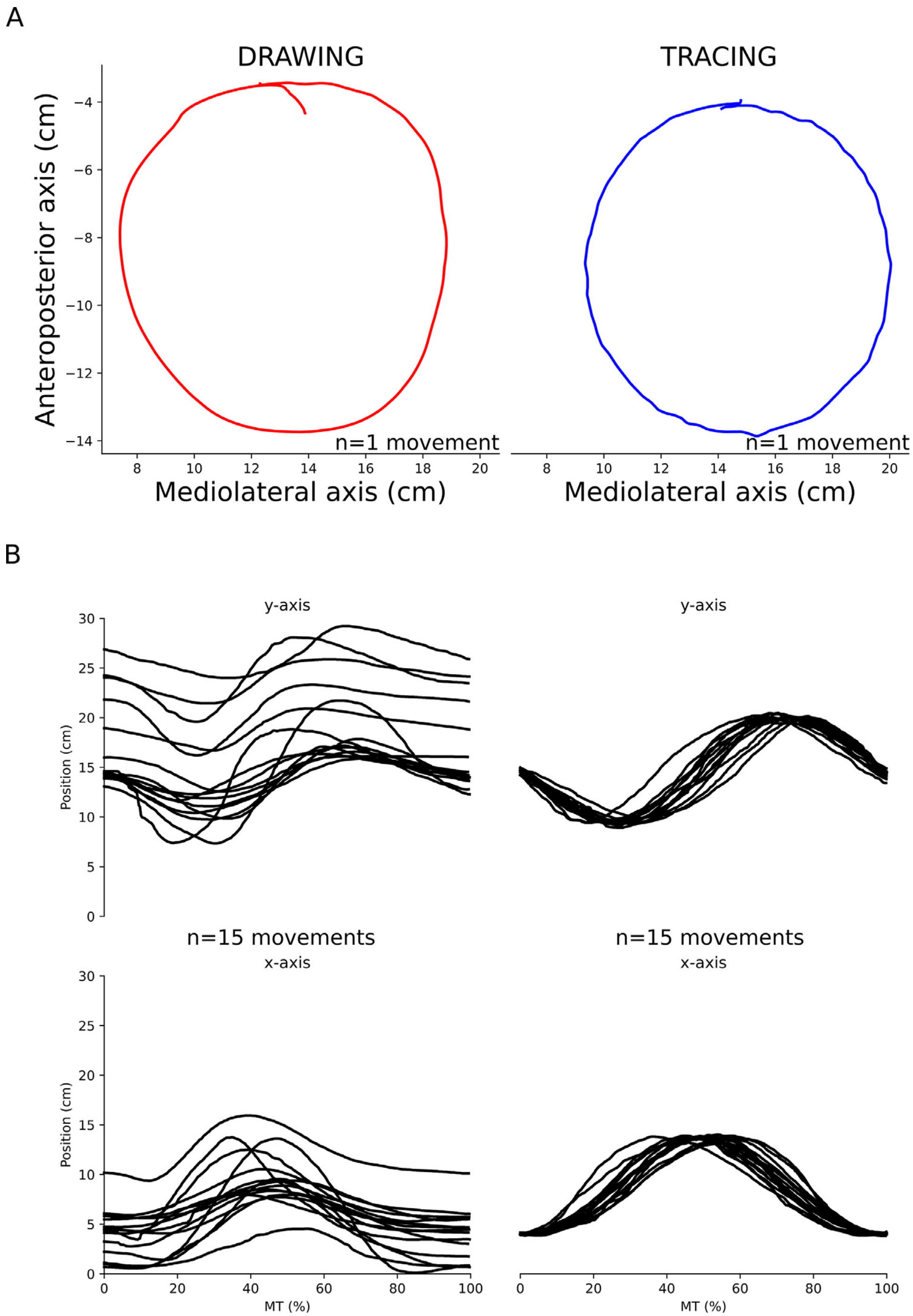

Fig. 1. Movement trajectories (MTr). A. Representative MTr as performed by single subject during the drawing task (left) and during the tracing task (right). B. Plots displaying the y (top panels) and x (bottom panels) coordinates as a function of percentage movement time (MT), for each task (for better display $n = 15$ movements are shown in the figure).

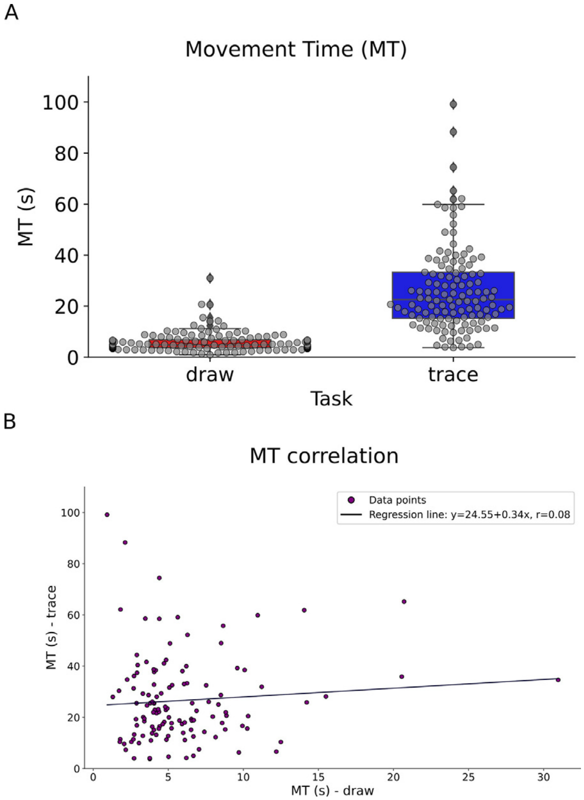

Fig. 2. Movement Time (MT). A. Boxplots showing the MT distribution and comparison between tasks. The error bars represent the dataset's minimum, i.e., the 25th percentile minus 1.5 × the Interquartile range (IQR) and maximum i.e., the 25th percentile plus 1.5 × IQR. B. Scatterplot showing MT during drawing vs tracing. Each dot represents the MT values for drawing and tracing for each subject. Regression analysis did not reveal any linear relationship between MT during drawing and MT during tracing.

length vector, from which the sampling frequency was determined. Mean sampling frequency was 52.17 ± 6.31 Hz for drawing movements and 49.48 ± 8.86 Hz for tracing movements. Figures were produced with the Python libraries matplotlib and seaborn [3,4]. For Fig. 1, the x and y components of the cursor position were smoothed with a 3rd order Savitzky-Golay filter with a frame length of 21 [5]. Movement time is shown in Fig. 2.

Ethics Statement

The study conformed to the ethical principles for research involving human subjects, as set out by the declaration of Helsinki issued by the World Medical Association's. Participants provided written informed consent for this study.

CRediT Author Statement

Eros Quarta: Data curation, Visualization, Software, Writing - Original draft preparation, Reviewing and Editing; **Riccardo Bravi**: Writing - Reviewing and Editing; **Diego Minciacchi**: Writing - Reviewing and Editing, Supervision; **Erez James Cohen**: Conceptualization, Methodology, Data curation, Software, Writing - Original draft preparation, Reviewing and Editing, Supervision. Vedi: https://www.elsevier.com/authors/policies-and-guidelines/credit-author-statement

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships which have, or could be perceived to have, influenced the work reported in this article.

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Supplementary Materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.dib.2021.106763.

References

[1] E.J. Cohen, R. Bravi, M.A. Bagni, D. Minciacchi, Precision in drawing and tracing tasks: different measures for different aspects of fine motor control, Hum. Mov. Sci. (61) (2018) 177–188, doi:10.1016/j.humov.2018.08.004.
[2] R.C. Oldfield, The assessment and analysis of handedness: the Edinburgh inventory, Neuropsychologia (9) (1971) 97–113, doi:10.1016/0028-3932(71)90067-4.
[3] J.D. Hunter, Matplotlib: a 2D graphics environment, Comput. Sci. Eng. (9) (2007) 90–95, doi:10.1109/MCSE.2007.55.
[4] M. Waskom, The seaborn development team, (2020), doi:10.5281/zenodo.592845.
[5] A. Savitzky, M.J.E. Golay, Smoothing and differentiation of data by simplified least squares procedures, Anal Chem (36) (1964) 1627–1639, doi:10.1021/ac60214a047.