

Abstract

The **skilled hand** in sports is usually determined by a handedness questionnaire [1], but it is blind to forced right-handed correction and **does not measure motor performance**. We invented a new method to easily evaluate each hand's **motor skill** by quantifying the variability of fast repetitive motion. Unlike other measures of motor performance that require customized equipment, our method is practical as it uses a **smartphone's accelerometer** to determine motor skill, making it easier to use in the field and at home. Our method could detect individuals who were forcibly corrected as their left hand was more skilled than the left hand of natural right-handers. In the near future, we plan to use our methodology to **quantify sports training** aimed at specific movements, and to **motivate physical rehabilitation** via daily feedback. It may also serve as a tool in understanding how and why the brain's control of the left and right arms is different.

Quantifying motor skill

Preferred and skilled hand could be different



Q1. When **forced to be right-handed**, which hand is the skillful one?

Q2. How to **quantify** skill?

Major hurdles

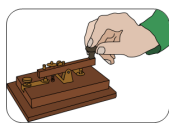
Problem 1. Unbiased motor skill determination



Forced right-handers may mistakenly use the **wrong hand** for sports.

Trainers cannot easily determine the skilled hand.

Problem 2. Need for custom equipment



Tapping rate (30s)

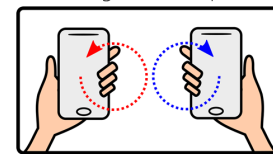


Peg-in-hole task (20-40s)

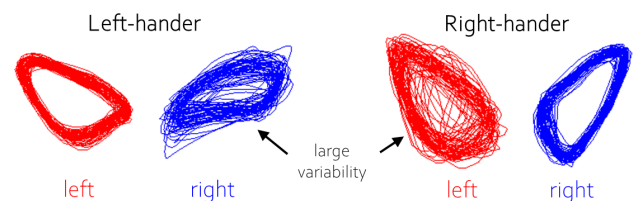
Past methods use **custom equipment** to determine skill, making them **impractical for everyday-use**.

Measuring motor skill with a smartphone

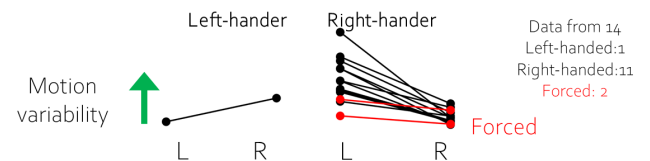
Motor skill was defined as **motion with low variability**, and was measured using the smartphone's accelerometer.



Rotate quickly for 15s per hand (total 30s)



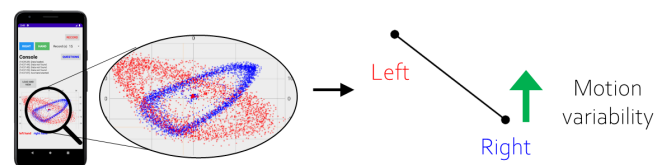
Answer 1. Forced right-handers are more skilled with the right hand.



Answer 2. Motor skill is quantifiable with motion variability.

Summary

- Effect of forced correction apparent by quantifying motor skill as **low motion variability**.
- **Easy to measure**, has potential to quantify sports training and **left-right skill balance**.



References

- [1] A. Takagi, S. Maxwell, A. Melendez-Calderon, E. Burdet, "The dominant limb preferentially stabilizes posture in a bimanual task with physical coupling," *Journal of neurophysiology*, Vol. 123, No. 6, pp. 2154-2160, 2020.
- [2] R. C. Oldfield, "The assessment and analysis of handedness: the Edinburgh inventory," *Neuropsychologia*, 1971.

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