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## Interpersonal Synchronization between Sprinters: An Observational Study of the Japanese 100-m Record Race

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### INTRODUCTION:

Athletes' performances are determined not only by individual ability but also by environmental states, especially the behavior of competitors. Previous studies suggest that spontaneous interpersonal synchronization occurs when individuals can see and hear each other's action. One study reported interpersonal synchronization between Usain Bolt and Tyson Gay in the 100-m race in which Bolt broke the world record and Gay broke the U.S. record (Varlet & Richardson, 2015). This report suggests that interpersonal synchronization may, in some cases, enhance an athlete's performance. In this study, we report a new case of the potential positive effect of interpersonal synchronization on athletes' performances.

### METHODS:

In the men's 100-m final at the Fuse Sprint (Tottori, 2021) in Japan, the first-place sprinter broke the Japanese 100-m record, and the second-place sprinter set his new personal record. These two sprinters ran side-by-side throughout the race. We analyzed the video of this race using deep learning-based estimation of human joint coordinates (OpenPose) (Cao et al., 2021). First, we obtained time series data of ankle joint coordinates for each sprinter. Then, to examine the degree of synchronization between two sprinters, the relative phase between their steps was then calculated using the negative peaks of the time series data. We also analyzed the video data of preliminaries in which the sprinters ran in different races to determine the chance level of synchronization.

### RESULTS:

Our results showed that the difference in cadence between the two sprinters was smaller and the relative phase between the two sprinters was more synchronized (inphase) in the final race compared to the chance level of synchronization determined by the preliminary races.

### CONCLUSION:

These changes in cadence or relative phase could not be explained by the difference in running speed between the final and the preliminaries because the time difference between them was the same (0.06 seconds) in the final and the preliminaries. This result supports the hypothesis that spontaneous interpersonal synchronization can occur between the two sprinters running side by side. It is noteworthy that both the world and Japanese 100-m records were set in races in which the first- and second-place sprinters synchronized their running movements. Our study provides additional evidence to suggest that interpersonal synchronization can influence the cadence of sprinters and enhance their performance.

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