

Abstract

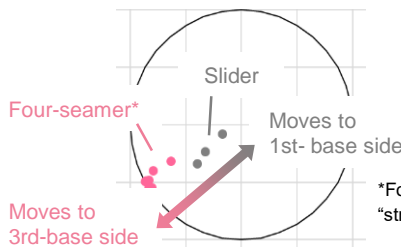
Athletes' perceptions are extraordinarily sensitive, but they do not necessarily capture the physical world as it is. We accurately quantified the **physical characteristics of pitched baseballs**, and then investigated **how batters perceived them**. In the physical measurement, we devised a technique to easily measure the 3D rotation characteristics of the ball using a single camera. In the perceptual measurement, we found that **the batters' perception of the ball's horizontal movement in the trajectory was systematically biased**, even though they discriminated small differences in the movement. Moreover, we found that the direction of their bias was reversed, depending on the pitcher's handedness. In sports science, physical measurement tends to be emphasized, and the gap between the physical characteristics and players' perception is at issue. **Combining physical and perceptual measurement to identify the cause of such a gap** could lead to a dramatic revolution in training and coaching.

Physics

Directions of ball rotation axis for an exemplary right-handed pitcher. 2D ball diagram from the batter's view. The rotation axes (dots) and ball's horizontal movements were analyzed in detail.



3D measurement of ball rotation



*Four-seamer is "straight" in Japanese.



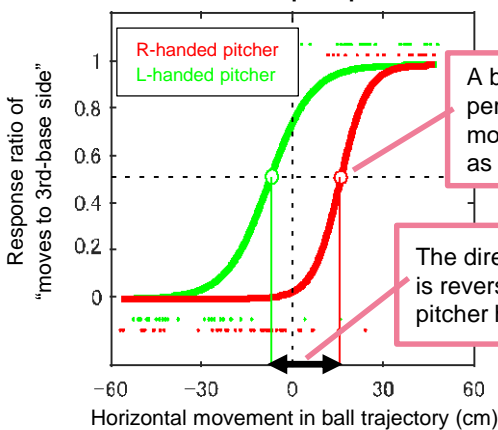
Physical trajectory of four-seamer

Most four-seamers for right-handed pitcher physically move to 3rd-base side

This measurement technique is being tested for practical use with professional and amateur baseball teams, and the Japan Women's National Softball Team.

Perception

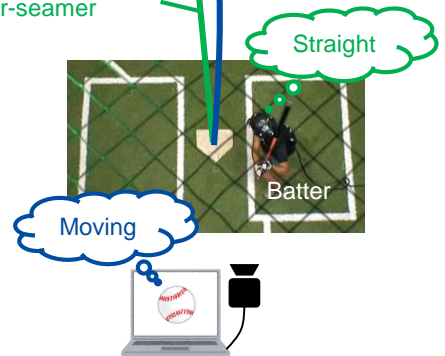
An example of batter's perception



A batter illusorily perceive a physically moving ball's trajectory as "straight".

The direction of the illusion is reversed, depending on pitcher handedness.

Perceptual trajectory of four-seamer



Perception is biased in the direction the four-seamer is perceived as "straight".

References

[1] D. Nasu, T. Kimura, M. Kashino, "Do baseball batters perceive straight ball trajectory as straight?" *Proc. 2020 Conference on North American Society for Psychology of Sport and Physical Activity*, 2020.

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