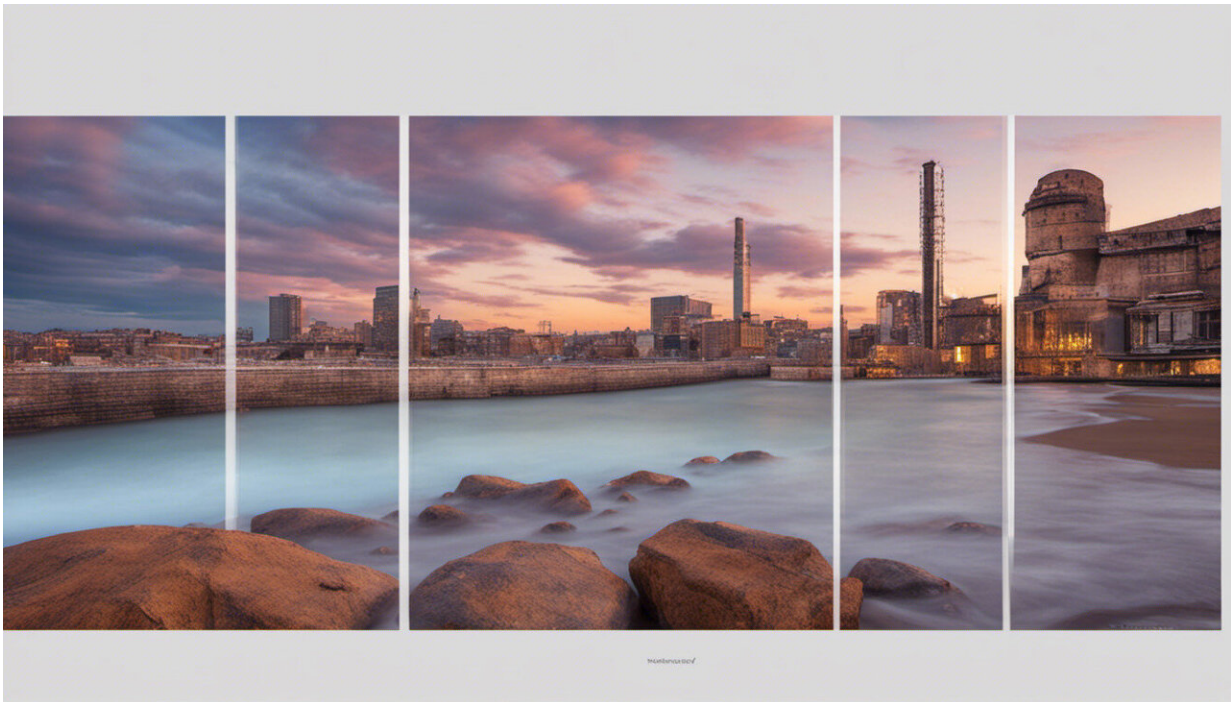


Science uncovers the secret to superb shots in soccer

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Credit: AI-generated image ([disclaimer](#))

Soccer, also known as football, is the most popular sport in 57 countries, and its players are among the most highly paid athletes in the world; therefore, every shot is valuable. Knowing how to adjust foot orientation and swing when kicking the ball can help players understand how to improve their shots on goal, giving them a competitive edge.

In a study published last month in *Proceedings of the Institution of Mechanical Engineers, Part P: Journal of Sports Engineering and Technology*, researchers at the University of Tsukuba focused on how the [foot](#) interacts with the ball to achieve desired ball trajectories.

"The point of impact on the ball matters. For a straight ball trajectory, aim close to center, otherwise, aim off-center—for a curved ball trajectory, aim closer to the near side of the ball, and for a knuckle ball, aim closer to the far side," explains first author Mr. Kimachi.

However, although the distance of the impact point from the center of gravity of the foot affects ball rotation to produce straight, curved, or unpredictable ball trajectories, it is a factor that indicates the foot angle of swing toward the ball that dictate where (i.e., location of point of contact) and how (i.e., angle of attack) the foot will strike the ball.

"Using high-speed 3D motion capture technology, we confirmed that the correlation between the angle of the swing vector and the resulting ball rotation was high," senior author Professor Nakayama explains. "We then characterized the foot-to-ball interactions in straight, curved, and knuckle-ball kicks."

The research team found that, for all three types of kicks, toes are pointed downward and the foot is rotated outward; however, for curved and knuckle-ball trajectories, the foot is everted slightly less to allow the inside of the foot to make contact with the ball. In addition, for curved trajectories, wide swing angles allow more of the face of the inside to make contact with the ball. For straight trajectories, the top of the instep is the area of the foot that made contact with the ball.

Now, when coaching [players](#) in developing their shooting skills, coaches can instruct players on ways to achieve the outcome (for example, "for a curve shot, kick from a wide inside angle and [angle](#) your foot so that

your impact (initial contact) point on the ball is off-center"). The findings of this study can be used to help improve shooting [skills](#) in [soccer](#) development programs and can likely be extended to other [ball](#) sports.

More information: Kaoru Kimachi et al, Features of ball impact in straight, curve and knuckle kicks in soccer, *Proceedings of the Institution of Mechanical Engineers, Part P: Journal of Sports Engineering and Technology* (2022). [DOI: 10.1177/17543371221101234](https://doi.org/10.1177/17543371221101234)

Provided by University of Tsukuba

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