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COLLEGE BASKETBALL

The Continuing Quest for the Perfect Shot

A shot-analyzing technology developed by Noah Basketball argues that players aiming for a swish are doing it wrong



Moritz Wagner of the Michigan Wolverines takes a shot over Minnesota's Reggie Lynch. PHOTO: PATRICK SMITH/GETTY IMAGES

By **ANDREW KAHN**

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Michigan sophomore Moritz Wagner's three-point shot was badly off when the Wolverines played Ohio State earlier this season. Two attempts barely grazed the rim and a third was an air ball on the way to finishing 0-for-4 from three-point range.

In a subsequent practice, Michigan head coach John Beilein set out to fix Wagner's problems using one of basketball's hottest new diagnostic tools: a machine that measures the arc of a shot as it reaches the hoop. The shot-analyzing technology, developed by an Alabama-based company called Noah Basketball, uses a sensor placed high above the backboard to generate data documenting precisely how each shot approaches the hoop.

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Noah's data shows that an important factor is the angle from which each shot drops toward the basket. A ball dropped from directly above the rim has an entry angle of 90 degrees; Noah's data says the ideal shot comes in at about 45 degrees.

Wagner's practice session showed that he was shooting the ball far too high, coming in at around 53 degrees. Beilein knew they had no chance of going in and pressed Wagner to adjust by flattening his shot.

"By the time we were done, he was draining threes all over the place at 45 (degrees), 46, 47," Beilein said. Wagner, a 41 percent three-point shooter for the season, shook his slump and nailed 8 of 17 (47%) from deep the next four games.

Noah's chairman and founder is Alan Marty, a former college player whose inspiration was teaching his young daughter to become a better shooter; the company's

name is a play on Noah's Ark (arc.). Chief Executive John Carter, who majored in mechanical engineering major in college, was brought in as CEO and moved the company from Silicon Valley to Alabama.

Noah recently won first place in the startup competition at the prestigious MIT Sloan Sports Analytics Conference. Marty's daughter Rachel—who went on to play college ball at UC San Diego— is now pursuing a PhD in bioinformatics while also working at a cancer research center in Switzerland. A paper she co-authored, analyzing more than a million three-point shots captured by the Noah system, was also presented at the conference.

The quest for the perfect basketball shot had long been influenced by aesthetics, not science: namely, the beauty of a high-arching shot that seems to drop from the heavens to swish through the net without even touching the rim.

But Noah's data shows that shooters who aspire to that are creating greater risk of a miss. If they shoot the ball long, there is a good chance that it will hit the back of the rim and bounce in. But if the ball is short and hits the front of the rim, it more frequently results in a miss.

The more reliable approach, Noah contends, is a lower angle shot that comes in at about 45 degrees. It aims not for the center of the 18-inch-diameter rim, but about 11 inches from the front of the rim, a little more than halfway.

Both approaches increase the chance of a shot hitting the back of the rim and going in. Carter calls this a "BRAD" shot, an acronym for "back rim and down." Before he had the data to prove it, Carter noticed the elite shooters he tested, like retired Hall of Famer Chris Mullin, often sank shots that touched the back of the rim.

"If you're teaching your players to swish every shot, you're teaching them to miss short," says Noah Chief Executive John Carter.

Larry Silverberg, a professor in the engineering department at North Carolina State University who is not affiliated with Noah, has authored several papers on the physics of the basketball shot. Initially, he focused on the shooter's release angle. But that varies based on a player's height and mechanics. After learning about Noah, he looked at entry angle.

"I studied it in detail and I certainly agree with it," Silverberg says of the 45-degree entry angle. "I love a physics rule of thumb."

Noah has been selling product for about 11 years. An earlier version of Noah's system involved a device mounted on a wall near the basket that called out the arc of each shot after it hit the basket; the data is also captured in a database for later analysis.



Five NBA teams, including the Golden State Warriors, now use Noah and several more have expressed interest. PHOTO: LARRY W. SMITH/EUROPEAN PRESSPHOTO AGENCY

But it was only able to measure shots take from directly in front of the basket. Last summer, Noah released an updated system that can measure shots from anywhere on the court. It can also measure how far left or right of center each shot is.

Carter says Noah sold a few thousand of the older unit, with high school teams and dozens of Division I programs among the clientele. He says five NBA teams, including the Golden State Warriors, now use Noah and several more have expressed interest as a result of the recent Sloan conference. Players and coaches like that the Noah system doesn't involve any wearables or specially outfitted basketballs.

The search for the perfect shot arc goes back at least 60 years, when an assistant coach at the University of Denver, Dave Mullaney, published a paper in the *Athletic Journal*. He, too, came to the conclusion that 45 degrees was the right entry angle, though Silverberg says his math was off and he more or less got lucky in arriving at the right answer.

Mullaney suggested a practice set up that would allow a coach to record player's shots by standing to the side and observing the ball as it passed through the hoop. The feedback a shooter gets from Noah is perhaps a little more accurate.

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