

In the blink of an eye

Scientist breaks down hitters reaction and response times

BY SCOTT JENKINS
The Battalion

From 60 feet 6 inches away, a man glares at his adversary. But it is not high noon, and this is not the O.K. Corral. He is standing at home plate with a bat in his hand. A baseball is about to be launched in his direction. His task is to hit the ball with the bat before it gets by him.

This is one of many scenarios examined by Yale professor Robert K. Adair, who, when not studying the physics of subatomic particles, studies the physics of baseball. He discussed some of his work at the 2000 annual meeting of the American Association for the Advancement of Science (AAAS) in Washington, D.C.

According to Adair, strong-armed pitchers can propel a baseball at around 90 mph, so that it covers the distance from their hands to home plate in about 0.4 seconds (400 milliseconds). Adair analyzes

what must happen biochemically and biomechanically for the batter to hit the ball, as well as the time it takes for those physiological events to happen. His goal is to understand how a batter decides to swing (or not to swing) in such a brief time span.

First, the cells in a batter's eyes must assemble a series of pictures of the incoming ball. The electric pulses that encode this image must pass through nerves to the brain. The brain must process and interpret the pictures, so the batter can judge the spin and the path of the ball.

Adair's calculations estimate that it takes 75 milliseconds for the brain to assemble the information sent by the eyes into a picture, and only after that time is it physically possible for the brain to "see" the ball.

One person who knows the importance of this initial recognition is Daylan Holt, a junior agricultural economics major and member of the Texas A&M baseball team.

"It's crucial that [the batter] pick up the spin of the ball immediately," Holt said. "It can give you an idea of what kind of pitch it is."

An experienced batter knows what to look for in a spinning ball. Holt said that seeing a red spot

(from the ball's red laces) surrounded by blurry white just outside it signifies the spinning pattern of a curve ball, for instance.

Being able to judge the trajectory of the ball requires processing a series of images of the ball, which then can be extrapolated by the batter to guess where the ball will be when it gets to the plate. That takes more time.

"If he uses only the earliest information [about the pitch], errors will be greater, but the batter has more time to pick the best swing," Adair said. "But if the batter waits too long to get more information about the pitch, he may not have enough time to swing." Adair suggested that 100 milliseconds may be the optimum time to see enough of the ball's path, but still have time to swing.

The batter's window of time to judge the ball and decide what to do is sandwiched on one side by the processing and interpreting of visual information, and on the other side by the time it takes for the brain to send instructions to the muscles, telling them the precise timing of contractions that will swing the bat correctly.

The time needed to actually swing the bat

was determined by Adair to be 150 ms, so that to meet the incoming ball at the plate, the swing must start no later than 250 ms after the pitch is released. And since it takes time for brain commands to travel through the biological wires, or neurons, and activate the muscle cells, commands must be on the way even before that.

Batters like Holt know all too well the precious little time the batter has to recognize the pitch and decide on the swing.

"Almost as soon as you see the ball, you need to decide what to do," he said.

Adair also discussed how different types of pitches make the batter's job even harder. For example, a fast ball decreases the time the batter has to think, increasing the chance that he will miss-hit the ball, for example.

According to A&M batter Holt, though, speed is not the most difficult thing to deal with, it is the deception.

"Movement is better than velocity," he said.

When the ball moves, as in a curveball, it makes judging trajectory more difficult. "Sometimes you can adjust [your swing] late when you see the ball break, but it's very difficult to do," Holt said.

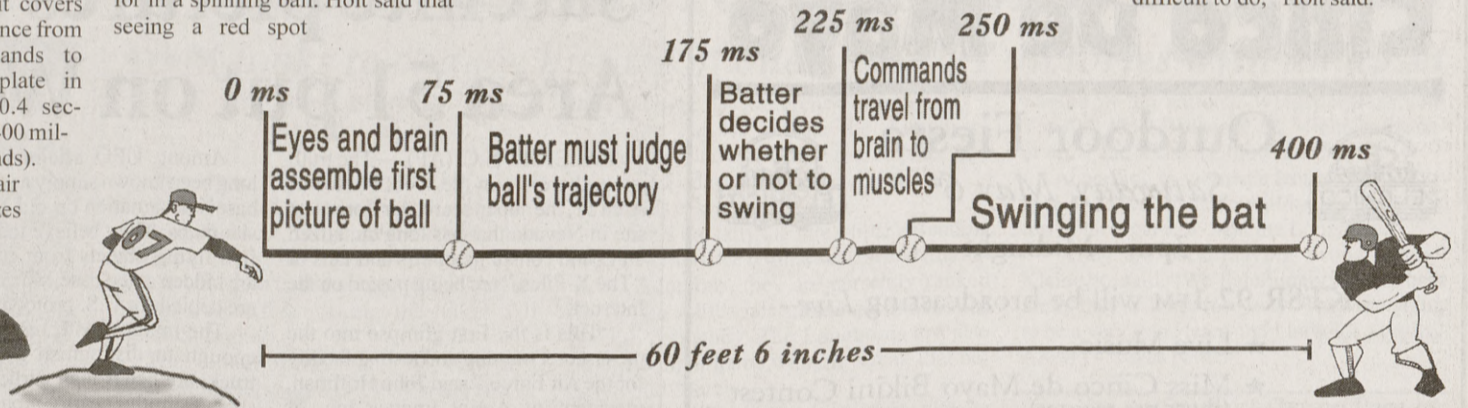


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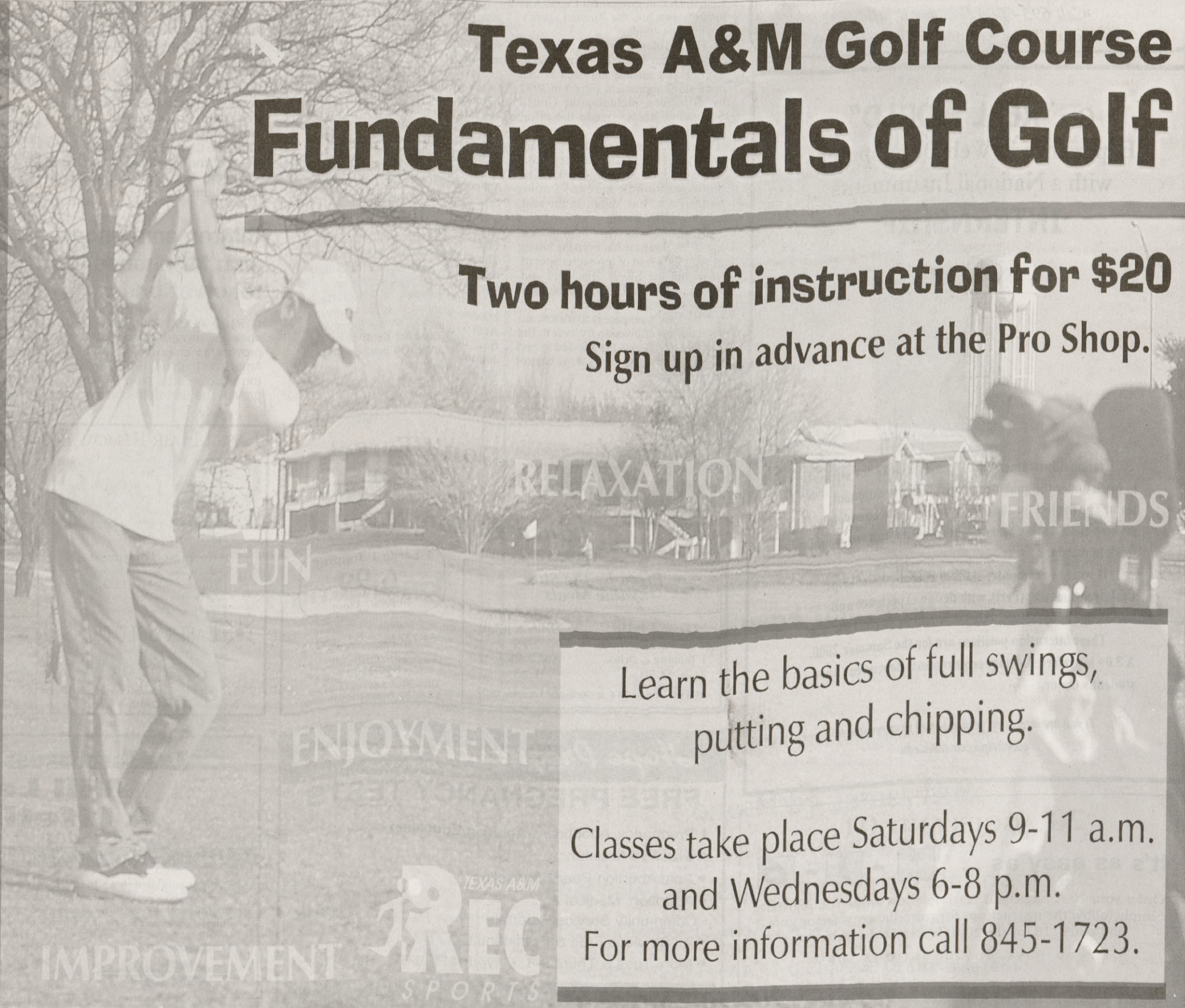
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