

# Why the slow paced world could make it difficult to catch a ball...

August 4 2008

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BBSRC researchers at the University of Birmingham have uncovered new information about the way that we perceive fast moving, incoming objects – such as tennis or cricket balls. The new research, published today in the *Proceedings of the National Academy of Sciences* (PNAS), studies why the human brain has difficulty perceiving fast moving objects coming from straight ahead; something that should be a key survival skill. The research has implications for understanding how top-class sportspeople make decisions about playing a shot but could also be important for improving road safety and for the development of robotic vision systems.

The information that the brain uses to process moving objects and to estimate their likely trajectory – which can then be used to decide whether to move out of the way or how to play a shot or catch a ball – is biased by the generally slow moving world around us. Dr Andrew Welchman, a Biotechnology and Biological Sciences Research Council (BBSRC) David Phillips Fellow, has discovered that this bias affects the way we perceive and interpret objects approaching from dead ahead far more than objects moving side-to-side in our field of vision.

Dr Welchman explains: "We may think we live in a fast moving, hectic world, but statistically our environment moves around us slowly. Apart from the odd speeding car, buildings, landscape and walls around us all move past us at slow and predictable speeds. Our brains are constantly building up a statistical picture of the world around and, based on experience, it is a statistically slow world.

"When an object moves quickly – be it a football, cricket ball or, for our ancestors, a spear – our brains have to interpret the movement rapidly and, because our brains draw on experience, it's often biased by what it already knows. The less certain we are about what we see, the more we are influenced by the brain's statistical assumptions, which means in some circumstances we get it wrong."

The human visual system can interpret sideways movement better than it can the movement of objects straight towards us, and this affects our judgments about objects coming our way. Working with colleagues at the Max Planck Institute in Tuebingen, Germany, Dr Welchman developed a mathematical model to show how the brain predicts the motion of an incoming object and tested this with experiments. His model shows that our previous experience of the world around us guides our perception more for objects that come straight towards us than when objects move sideways. The result of this is that approaching objects can look slower than they are and we can believe an object will miss us when actually due to hit us.

Dr Welchman said: "Although it is not surprising that sportsmen who practice a lot build up a better statistical picture in their minds about where a ball might go, it is surprising that what should be a vital survival skill is based on such a trial and error learning experience."

The research has serious applications beyond the world of sports. Motorists driving in poor visual conditions such as fog often drive too fast for the conditions because they judge speed inappropriately. The poor visual information produced by fog means the brain relies more on its assumption that the world moves slowly, so the car's motion is judged slower than it actually is.

Dr Welchman said: "The research also has important long term application to robotics and assistive technologies. Capitalising on

nature's design is a good way of building artificial visual systems for robots – as humans get visual judgments right a lot more often than the best current robot systems. Further, knowing the situations in which humans get it wrong is a useful starting point for the design of assistive devices to help correct those errors before they have serious consequences."

Source: Biotechnology and Biological Sciences Research Council

Citation: Why the slow paced world could make it difficult to catch a ball... (2008, August 4)  
retrieved 20 April 2024 from  
<https://medicalxpress.com/news/2008-08-paced-world-difficult-ball.html>

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