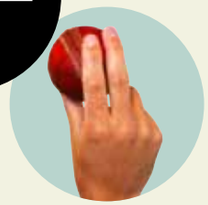
The science of swing

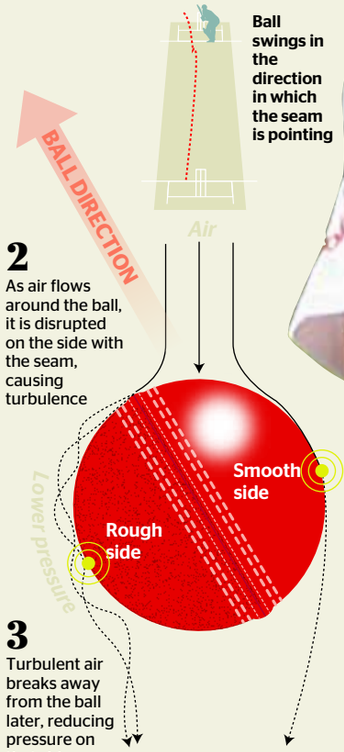
James Anderson's ability to swing the ball could decide the fourth Test at Headingley. His success will depend on manipulating aerodynamics and creating subtle pressure imbalances on either side of the ball, by positioning the seam so it acts as a rudder. Contrary to cricketing lore, however, the weather will not be a factor: science suggests that none of the three types of swing are affected by cloud cover or humidity, although pitch conditions and wind can make a difference

Normal swing



1 The grip

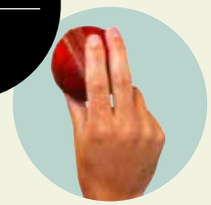
Bowler holds ball next to seam, with part of shiny side towards batsman, and points seam in direction he wants the ball to swing. For an outswinger, the seam points towards slip, for an inswinger towards fine leg



70mph optimum speed

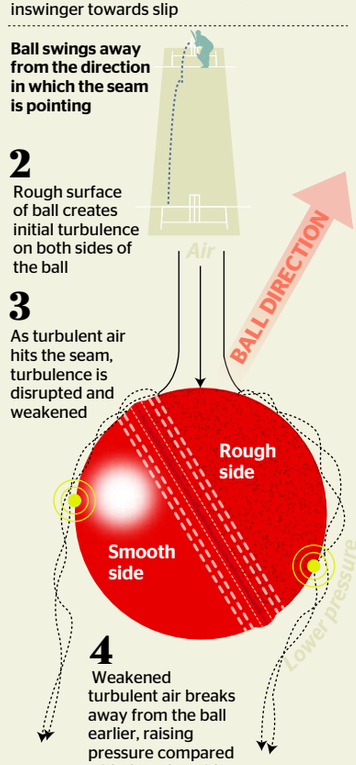
Swing difficult to achieve above 80mph

Reverse swing



1 The grip

Bowler holds ball next to seam, with part of rough side towards batsman, and points seam in the opposite direction to the way he wants the ball to swing. For an outswinger, the seam points towards fine leg, for an inswinger towards slip



90mph optimum speed

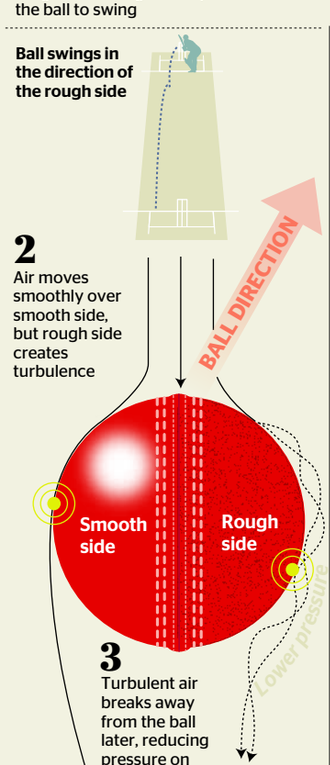
Roughened balls will reverse at lower speed

Contrast swing

At low speed

1 The grip

Bowler holds seam vertically, with rough side facing the way he wants the ball to swing



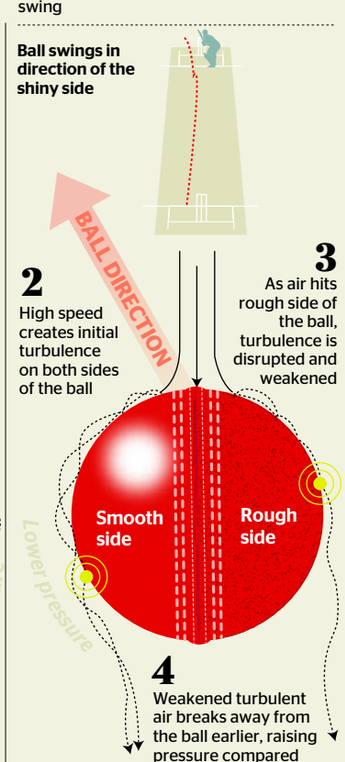
70mph optimum speed

Faster balls swing the other way

At high speed

1 The grip

Bowler holds seam vertically, with shiny side facing the way he wants the ball to swing



80mph optimum speed

Ball still swings if seam is less prominent

Weather report

- Experiments show that, contrary to popular cricketing belief, cloud cover and humidity seem to have no effect on swing
- Prevailing winds can disrupt turbulence patterns on the ball, promoting swing in particular grounds or from a particular bowling end

Pitch report

- **Grassy wicket:** can protect shiny side of ball, assisting conventional swing
- **Abrasive wicket:** can scuff up ball, creating rougher rough side and promoting reverse-swing
- **Very hard wicket:** can depress seam, making conventional or reverse swing impossible. Contrast swing may still be effective

Sultans of swing

George Hirst
- England, 24 Tests, 59 wickets at 30.00

Bob Massie
- Australia, 6 Tests, 31 wickets at 20.87

Richard Hadlee
- New Zealand, 86 Tests, 431 wickets at 22.29

Waqar Younis
- Pakistan, 87 Tests, 373 wickets at 23.56

Zaheer Khan
- India, 65 Tests, 210 wickets at 33.84