

What does it take to hit a tennis ball?

Visual information about the motion of the approaching (tennis) ball is processed in the visual system, which identifies the flying object (“Okay, that’s a tennis ball, not a volleyball.”) and computes its direction and velocity. (Sensory) information about the position of (our) arms, legs, and trunk in space are also computed by the brain to plan the appropriate positioning of the body for interception of the ball.

All of this sensory information ultimately reaches multisensory processing regions...where the information is combined to elicit the memory of earlier attempts to hit a tennis ball (attempts, I would add, of similar velocity, height, and spin versus your position on the court). In addition, theinformation for the planned behavior recruits activity in the amygdale, a structure concerned with emotion and social behavior (often called our emotional epicenter). The amygdale in turns activates the autonomic (automatic, occurring involuntarily) nervous system to prepare the body for action. (More or less, what we do instinctively without thinking about it). The multisensory association areas make connections with higher-order motor centers that compute a program (something like a World War II submarine captain computing the direction for a torpedo) for moving the racket into position.

This program is then passed on to the primary motor cortex for execution....Once the behavior is initiated the job of the brain is not over. As the arm is raised and the ball approaches, many minor adjustments of the initial motor program are made, based on more recent sensory information about the exact trajectory of the approaching ball before the arm moves the racket against the ball. Of course, as the behavior is being executed, the brain is also engaged in maintaining the player’s heart rate, respiration and other autonomic functions that are typically outside the awareness of the player.

There is an emotional component to properly hitting a ball in any sport. Our emotions well up in competitive situations where we feel pressured to succeed, the amygdala—the brain organ that mediates for fear—is activated as part of the process. Athletes often perform the sign of the cross or some other exterior expression of faith, in hopes of calming the amygdale so that it will impede the release of chemicals, such as cortisol, which raise our stress level. The calming gestures and thoughts may also trigger serotonin to be transmitted across the synapses, inhibiting firing activities in specific neural circuits; this can calm our anxieties.

The same exists for any situation life puts us in. Where there are stressors, the amygdala is prepared to respond, preparing the body for fight or flight. What we must do is facilitate that process better by learning the steps necessary to be mindful of our circumstances.

Source

Eric R. Kandel, James H. Schwartz, and Thomas M. Jessell, *Principals of Neural Science* (New York: McGraw Hill, 2000), p. 318.

