Method to His Bratness

Did John McEnroe's verbal abuse of line judges influence their decisions?

Former tennis star John McEnroe is remembered as much for his outbursts against umpires and line judges as he is for his seven Grand Slam victories. Also known as the Boy Wonder of Tennis and Superbrat, McEnroe is the only player ever to be disqualified from a Grand Slam event as a result of verbal abuse of officials (the 1990 Australian Open). Upon closer inspection, however, we see some method in his "bratness." Line judging in tennis requires the official to make an absolute judgment decision, which can result in two types of errors that have separate and unrelated causes. McEnroe's constant berating of umpires and line judges was his attempt to bias them toward making one of these errors in his favor.

So, what are these two types of errors, and how do they occur? In decision theory (also referred to as signal detection theory), these two errors occur because of the difference between what is actually true and what someone decides is true. In tennis, the ball is legally ruled to be in play when any part of it lands on or inside the lines that define the court. Figure 2.1 illustrates how often a ball would be called "out" as a function of where it landed relative to the boundary line on the court. Going along the horizontal axis from left to right illustrates how close the ball landed to the line—either well inside the line (on the left side of the axis) or well outside the line (on the right side of the horizontal axis). The dotted line in the figure illustrates a perfect world; in theory, a ball that lands outside the line is called "out" 100% of the time and a ball that lands inside the line is called "out" 0% of the time.

The dashed line in figure 2.1, however, represents reality—the calls that might be expected of a typical line judge. Note that the dotted and dashed lines overlap almost perfectly when the ball lands clearly in or clearly out, corresponding to the left and right extremes on the axis. However, they diverge as the ball lands closer and closer to the line. In reality, mistakes are made, and sometimes a ball that should be called "out" is not called "out," and vice versa. The gray area in the figure, where the dotted and dashed lines do not overlap, is, quite literally, that gray area in which the decision could have gone either way. It represents the difference between theory and reality.

Why are errors made when making simple decisions such as these? After all, the ball is either out or in, right? Decision theory suggests that we make decisions based on what we think we have seen. And what we think we have seen is based on an accumulation of sensory evidence—in this case, mostly

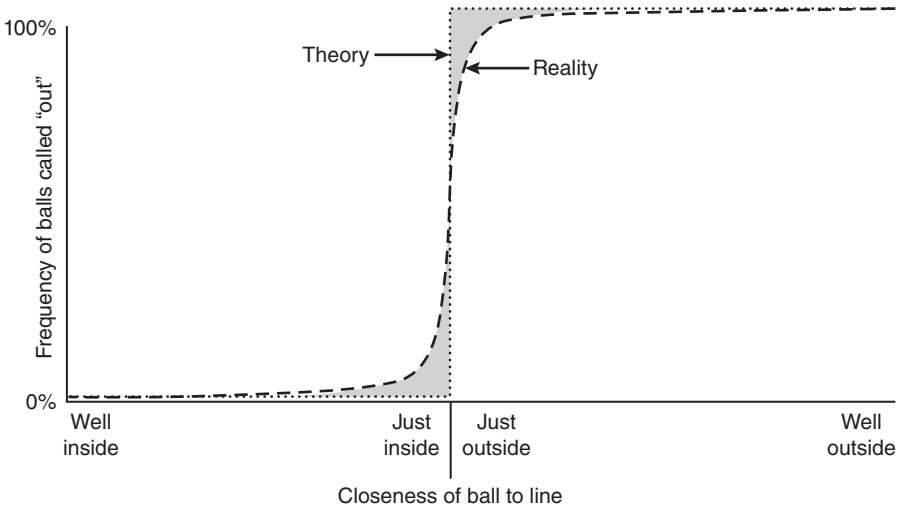

Figure 2.1 In theory, we should call all tennis shots that land outside the lines of the court "out." In reality, we call some shots that land inside the lines "out" and some that land outside "in."

visual evidence, which can be distorted. What we think we have seen may or may not be a faithful representation of reality. Let's think of the tennis line judge as a type of juror in a trial, who has to weigh the evidence provided by the lawyers and make a decision about whether the defendant is guilty or not guilty. In our case, the line judge is weighing the evidence accumulated through the senses and making a decision to call the ball "out" or "not out."

Decision theory states that people use accumulated sensory evidence to make these decisions. There is a subtle but important difference if you compare the horizontal axes in figures 2.1 and 2.2. In figure 2.1, the horizontal axis represents where the ball landed relative to the line. In

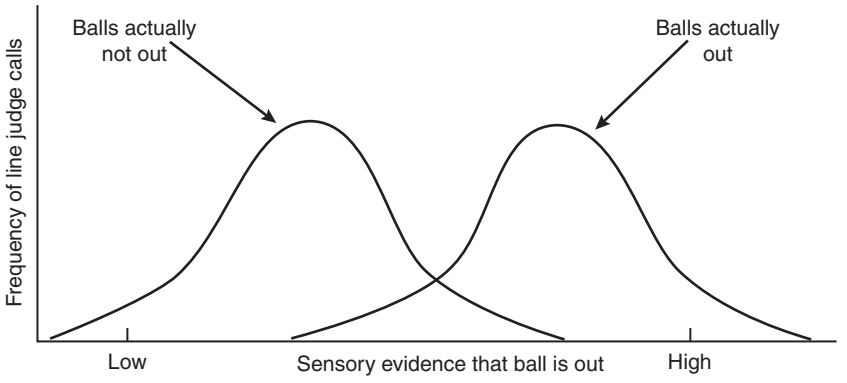

Figure 2.2 Signal detection theory applied to the task of judging whether or not a tennis shot has landed outside the lines of the court.

From T.D. Lee, 2011, *Motor control in everyday actions* (Champaign, IL: Human Kinetics).

figure 2.2, going from left to right along the horizontal axis corresponds to increasingly stronger and stronger sensory evidence that the ball has landed outside the court. As in a court of law, the evidence must be sufficient to prove that the defendant is guilty; otherwise, the juror is instructed to find the defendant not guilty. The tennis line judge faces a similar situation. The perceptual evidence must be sufficient to conclude that the ball was out; otherwise, the ball should be called "not out."

The relative frequency of balls landing on the court with the associated amounts of sensory evidence is illustrated in the two "normal curves" presented in figure 2.3. These curves just represent the amount of accumulated sensory evidence—the line judge still has yet to rule on whether or not the evidence is sufficient to call the ball "out." The other important thing to note about this figure is that the perceptual evidence for "out" and "not out" is not always clear-cut; sometimes the evidence for an "out" call appears to have less strength than might be needed for a "not out" call. The spin that a ball takes after hitting the surface or the shading of light on a bright, sunny day might distort this visual information. This potential for confusion is represented in the graphs by the overlap of the two curves.

According to decision theory, the line judge establishes a criterion point along the horizontal axis that serves as a cutoff; beyond that criterion (to the right of it in figure 2.3), the judge will conclude that the ball was out. Failure to obtain sufficient perceptual evidence to rule that the ball was out will result in a "not out" call (i.e., to the left of the criterion point). The criterion point in figure 2.3 has been set at an arbitrary position along the horizontal axis that bisects both curves. This is a critically important detail about decision theory, because this bisection of both curves sets up the scenario in which the line judge could be correct for two reasons and incorrect for two reasons.

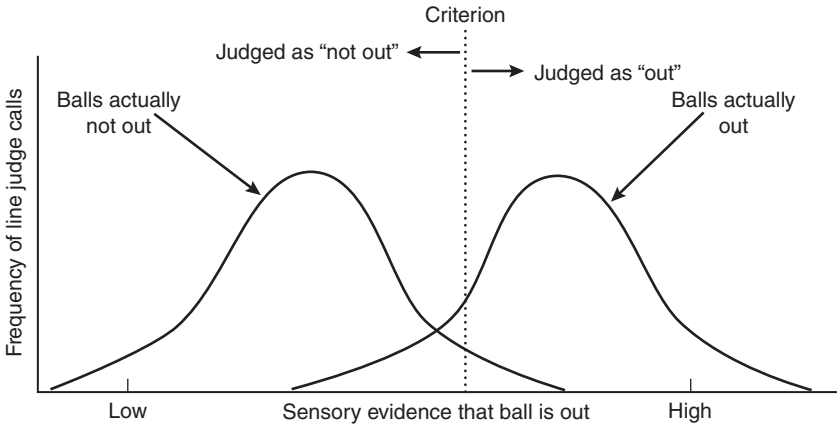

Figure 2.3 The tennis line judge uses the accumulated perceptual evidence to establish a criterion to make the line call.

From T.D. Lee, 2011, *Motor control in everyday actions* (Champaign, IL: Human Kinetics).

The line judge is correct when the ball is correctly called "out" or "not out." The line judge is incorrect, of course, when a ball is called "not out" when, in fact, it was out, and called "out" when it was not out. The shaded region in figure 2.4 illustrates the latter error. This shaded region represents the area under the left curve, the distribution of "not out" balls that lies to the right of the criterion, and hence are ruled to be out. In making this error, the line judge has accumulated sufficient perceptual information to surpass the criterion point to make an "out" call. The other error is represented by the striped section in figure 2.4—a ball that is judged to be not out when in reality it was out. This region represents the area under the right curve that lies to the left of the criterion. In this instance, the judge has not accumulated enough perceptual information to reach the criterion to call the ball "out," even though, in fact, it was out.

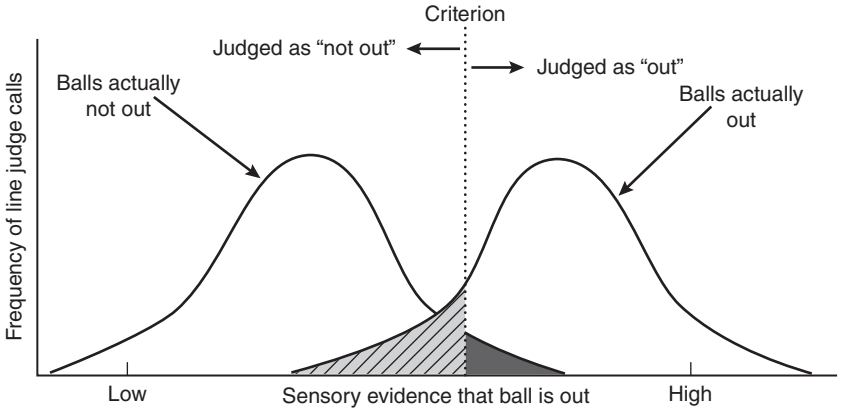

Figure 2.4 Balls that are judged to be out can sometimes result in errors if the ball was actually not outside the lines of the court (shaded area), and balls that are judged to be not out can sometimes result in errors if the ball was, in fact, outside the lines of the court (striped area).

There are two important things to know about these decision theory figures. One is that the degree to which the two distributions overlap will influence the potential for error. A line judge whose perceptual representations have considerable distortion (sometimes called neural "noise") will have more overlap of the two distributions. Perhaps this line judge had been out too late the night before and is feeling the aftereffects, or is just not highly skilled at the job. Regardless of where the criterion is set, this judge will make many errors of both kinds. On the other hand, a judge who is highly skilled and keenly focused might have very little overlap of the two distributions. This highly skilled judge is likely to make few errors of either type.

The second important thing to notice is that because line judges set the criterion point for accumulated sensory evidence, they can move the point

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to the left or to the right along the horizontal axis. This second source of errors—or, more specifically, the reason one type of error might be traded for another—is the likely reason John McEnroe yelled at line judges. He was trying to influence where they set this criterion. Nothing McEnroe could do would change how much the distributions were overlapped. But, because the criterion is under the control of the individual, he was probably trying to intimidate the judges into shifting their criteria so that there was less likelihood of an unfavorable call in the future. His strategy in berating the officials was a deliberate attempt to get them to shift their decision-making criteria so that any error, regardless of its type, would more frequently go in McEnroe's favor.

Postscript: Baseball Umpire Jim Joyce

Early in the 2010 baseball season, Detroit Tigers pitcher Armando Galarraga almost became the 21st pitcher in the history of Major League Baseball to throw a perfect game (defined as a game in which no player on the opposing team safely reaches base; every batter records an out in every plate appearance). In the ninth inning, with two outs recorded, the 27th player to bat in the game hit a ground ball to the infield and, even though the runner appeared to be out at first base to every person in the ballpark that day, he was inexplicably called safe by umpire Jim Joyce. Upon closer inspection, Joyce later admitted that he made the wrong decision—that, in fact, the runner had been out and that Galarraga should have made history for pitching a perfect game. How could this error occur at such a crucial point in the game?

In postgame interviews, a contrite Joyce admitted that he was well aware of potential history in the making and the importance of getting the call right. Joyce is widely known as one of the very best umpires in the game, and one who would be among the least likely to make a favorable call for one team or another, regardless of the situation. In other words, it is highly unlikely that the blown call was due to a shift in bias. Instead, the nature of the situation, perhaps enhanced by the building excitement among the home crowd, the players, and indeed, the umpires, likely caused a heightened anxiety and more overlap of the two call distributions (out and safe), thereby inflating the chances of making an error. As Joyce later admitted, "I missed it . . . this is a history call, and I kicked the (expletive deleted) out of it."

SELF-DIRECTED LEARNING ACTIVITIES

1. What specific technical terms are used to label the four outcomes of decision theory? Search the available literature to find these technical terms, and use them to label specific areas of figure 2.4.
2. Decision theory has been applied to many situations in which two-choice, or binary, decisions must be made. Use the graphs in figures 2.1 through 2.4 to explain how errors occur in a binary decision situation other than that of a tennis line judge.

From T.D. Lee, 2011, *Motor control in everyday actions* (Champaign, IL: Human Kinetics).

3. For your application in question 2, suggest one factor that would shift the distributions closer together (more overlap) and one factor that would shift the distributions farther apart (less overlap).
4. For your application in question 2, suggest one factor that would shift the criterion to the left and one factor that would shift the criterion to the right. What impact would each of these shifts have on the expected frequency of each of the four outcomes?

Notes

- Here is a good review of the research on decision theory, with many examples of using signal detection analyses in the determination of decisions:

  Swets, J.A., Dawes, R.M., & Monahan, J. (2000). Psychological science can improve diagnostic decisions. *Psychological Science in the Public Interest, 1,* 1-26.

- Of course, automated tennis machines that make line calls have removed much of the error in making the types of decisions described in this story.
- You can listen to the recorded postgame interview with umpire Jim Joyce online:

  www.tinyurl.com/jimjoyceinterview

Suggested Readings

Schmidt, R.A., & Lee, T.D. (2011). Human information processing. In *Motor control and learning: A behavioral emphasis* (5th ed., pp. 57-96) Champaign, IL: Human Kinetics.

Schwartz, L. Sportscentury biography: McEnroe was McNasty on and off the court, ESPN Classic, www.tinyurl.com/johnmcenroeespn.