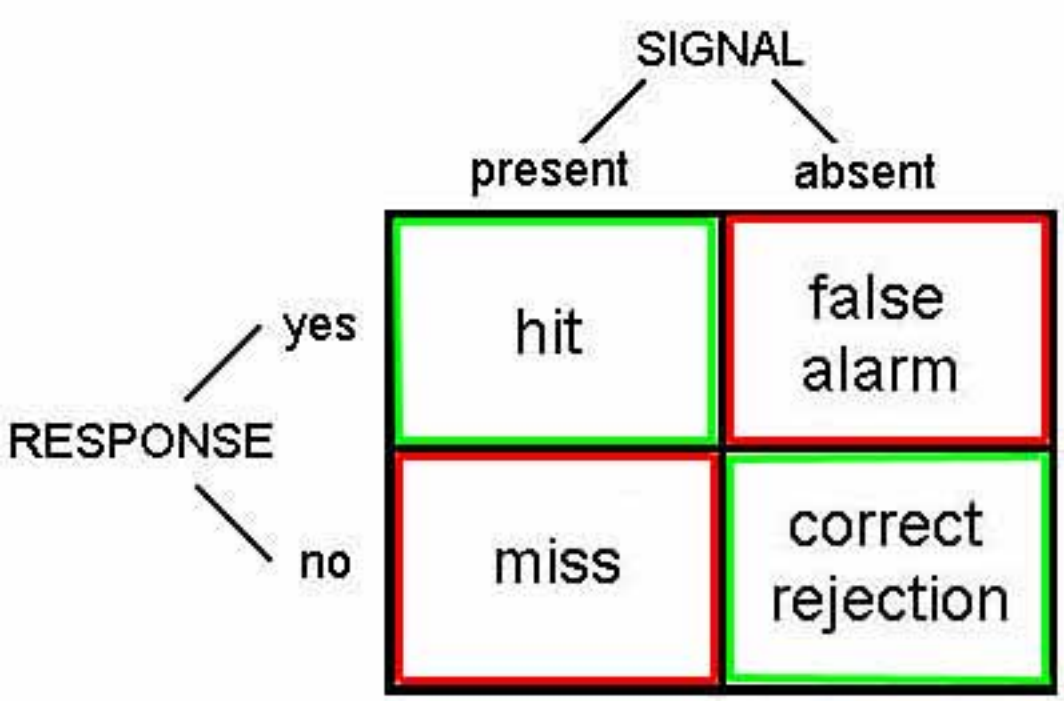
Signal Detection Theory

In the Quian Quiroga et al paper from Nature, Figures 1c, 2c, and 3c are signal detection ROC curves. What does that mean?

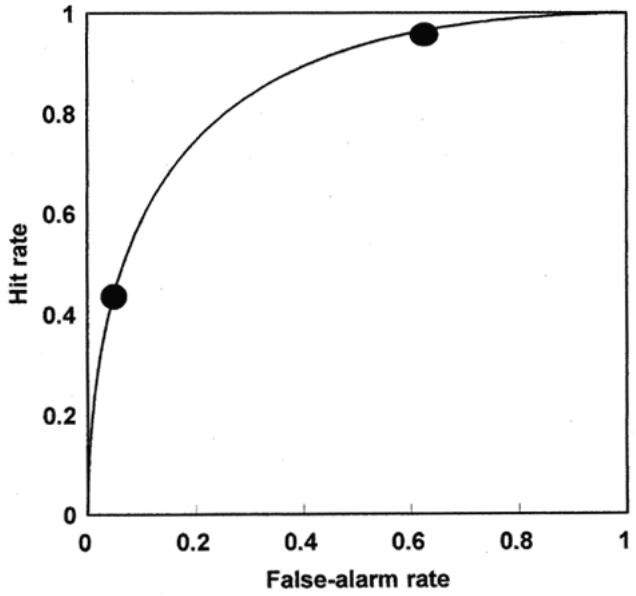
Assume that something you are asked to see or hear is either present or absent on a large number of trials. On each trail, the observer says whether or not he or she saw or heard the target. All of the responses can be classified in the 2 x 2 table on the next slide.


SIGNAL
present
absent
RESPONSE
yes
no
hit
false alarm
miss
correct rejection

Suppose someone had no idea whether the target was present of not and just said “yes” every time.

Because there are only two choices, the person’s answers would be recorded as a “HIT” every time. The person would have 100% correct answers, but they don’t really mean that the person detected the target. In Signal Detection Theory, the researcher keeps track of all the cells. In the case of our person who says “yes” every time, there will be a “yes” recorded every time the signal is absent as well. These are called the “false alarms,” saying “yes” when there is no signal. If the false alarm rate is very high at the same time the Hit rate is high, it means that the person was just saying “yes,” every time – what we call a response bias.

In Signal Detection theory, the graph of hits vs. false alarms is called a Receiver Operating Characteristic Curve and is abbreviated ROC.



If the Hits (y axis) go up faster than the false alarm rate (x axis), it means the observer is detecting the signal. This will make the curve arch into the upper left hand corner. If the signal goes up with the false alarm rate, the curve will be a straight diagonal line from lower left to upper right. That means no detectability.

The measure of how much the curve is arched up to the left is called d' (pronounced "d prime."}

Look back now at the curves in the article.