A neural mechanism for decision-making, or how I learned to stop worrying and love the bound

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With little sophistication, the spike rates from sensory neurons can be used to approximate useful statistics for decision-making. In the context of deciding between two sensory hypotheses, a simple difference in spike rate between sensory neurons with opposite selectivity is proportional to the log likelihood ratio in favor of one sensory interpretation over another. I will describe neural recording experiments that demonstrate the use of such a difference during decision-making in a 2-alternative direction discrimination task. The accumulation of this difference to threshold (a.k.a., "the bound") explains the speed and accuracy of simple decisions. A new probabilistic classification task, similar to the "weather prediction task" reveals a direct representation of log probability in parietal cortex. And, if time permits, I will explain how the brain uses elapsed time to decode such probability. Interestingly, the neural computations that underlie such decision-making were anticipated during WWII by Alan Turing and Abraham Wald. Turing applied this tool to break the German navy's Enigma cipher, while Wald invented the field of sequential analysis. In addition to mathematical elegance and winning wars, our experiments suggest that this computational strategy may lie at the core of higher brain function.