Simulation of the Learning to time (LeT) model of timing

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1 States dynamics

The states advance at a rate λ, which is a normal random variable.

$$\lambda \sim \mathcal{N}(\mu, \sigma),\ \lambda > 0$$

Every trial, a value is sampled and the trial advance from $t = 1$ until T, the time of reinforcement, so that the reinforced state is $N(t = T)$. The states transitions form the process $N(t) = \lceil \lambda t \rceil$. The N states starts at 1 and are activated serially. There are no upper bound of the states that can be activated, so the limits of $N(t)$ are determined by μ and σ. For example, if $\mu = 1$ and $\sigma = 0.1$, the states will be very close to the true T, but if $\sigma = 0.6$, there will be more reinforced states that are far from T. Figure 1 shows a simulation with $\mathcal{N}(\mu = 1, \sigma = 0.2)$. Note that if $\mu > 1$ the mean of the reinforced states (histogram of Figure 1) will be shifted above T, or below if $\mu < 1$.

Thus, the reinforced states $N(t = T)$ are a vector $\mathbf{N}^* = \boldsymbol{\lambda} T$

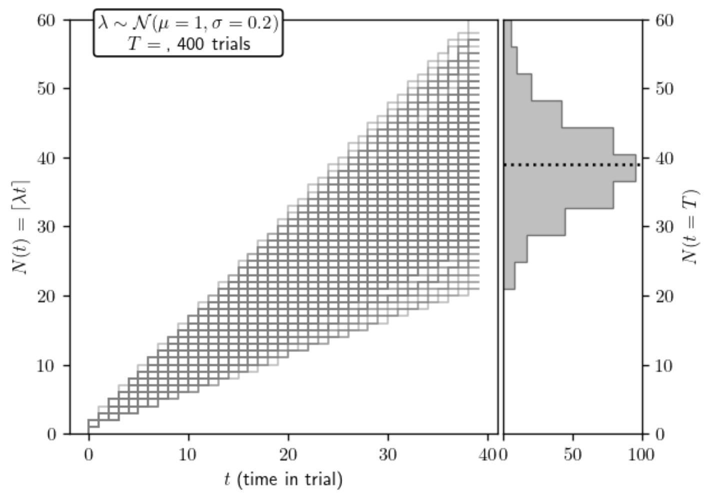

Figure 1: Example of a process of 400 trials. The left panel shows the state transitions for every λ sampled from the normal distribution in the textbox inset. At $T = 40$, the reinforced states spread around the true value of T, so they aproximate a normal distribution with mean $\mu \times t$ and standard deviation $\sigma \times t$ (right panel).