**The role of familiarity in signaler-receiver interactions**

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**Supplementary Material: Posterior distribution over ovulation time in the Bayesian learner model**

After observing a given female for *T* days, a male has measurements *x*1, *x*2, ..., *xT*. Of interest is the posterior over that female’s ovulation time, *p*(*τ*|*x*1, *x*2, ..., *xT*). It is calculated by first applying Bayes’ rule (absorbing an irrelevant normalization constant into the proportionality sign):

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We assume that the male uses a uniform prior over *τ*, even though this prior matches the true distribution only in the low-synchrony condition. Then, the posterior becomes proportional to the likelihood:

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This likelihood is not immediately available, because the distribution of **x** given *τ* is only known when also conditioned on the cycle parameters  and *A*, but those are not known. Therefore, the Bayesian learner would marginalize over those parameters:



Substituting the distributions from the generative model, we find:



We assume that the male does know the population parameters , , *μA*, and *σA*.

Both integrals are Gaussian and can be done analytically. We first perform the integral over :



Next, we perform the integral over *A*:



While this expression is indisputably monstrous, it is a well-behaved function of τ and its shape makes sense; example posterior distributions are shown in Fig. 1C-D.