Discussion of the paper by Fearnhead and Prangle

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Calibration is a way of assessing probaility statements against some idea of truth, usually reality. We are well-calibrated if $p\%$ of all predictions reported at probability p are true. This is close to Fearnhead and Prangle's definition: P_{ABC} is calibrated if

$$P(\theta \in A | E_q(A)) = q,$$

i.e., given that A is an event assigned probability q by ABC, then we are calibrated if A occurs with probability q. This differs slightly from previous definitions as the base measure (or 'truth') is defined not by reality, but by our definition of the prior, likelihood and summary, i.e., the distribution

$$\pi(\theta|s) \propto \int \pi(s|y)\pi(y|\theta)\pi(\theta)\mathrm{dy}.$$

In other words, they are not comparing P_{ABC} to reality, but to a modeller specified distribution.

Calibration, even with reality as the base-measure, is not universally accepted by Bayesians as something to strive for (Seidenfeld 1985). It is even more questionable here as we care about how statements we make relate to the world, not to a mathematically defined posterior. For example, the fact the prior is calibrated under this definition should give us pause for thought. Moreover, calibration in this case says noisy ABC is calibrated with respect to the user defined posterior only if we were to repeatedly do the analysis. In a particular analysis, nothing can be said, as we only generate one noisy data set (this criticism doesn't apply to Section 2.2 where noisy ABC is a more natural choice).

I prefer to view ABC as a method that provides exact inference under a different model (Wilkinson 2008), and to try and choose this alternative model to be of scientific interest. For example, if we believe there is model/measurement error on the simulator, with distribution $\pi(s^{obs}|y^{simulator}) = K((s^{obs} - S(y^{simulator}))/h)$ then kernel-ABC gives exact inference. If we were to now use noisy ABC we would have added two lots of error.

In summary, if you know your simulator is imperfect, then I would argue that it is better to attempt to account for the simulator's imperfections in the modelling and inference and to do exact inference, than it is to do an analysis using noisy-ABC that is calibrated with respect to some base measure we know to be meaningless.

- Seidenfeld T. 1985 Calibration, Coherence, and Scoring Rules. *Philosophy of Science* **52(2)**, 274-294.

- Wilkinson R. D. 2008 Approximate Bayesian computation (ABC) gives exact results under the assumption of model error. *arXiv*:0811.3355.