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Comment on Article by Berger, Bernardo, and Sun*

Judith Rousseau†

In this paper, the authors undertake to expose an encompassing principle to handle objective priors in competition, their difficulties, their contemners, and their multiplicity! Great target, for which we congratulate them. However, it may be a doomed attempt if they mean to achieve the ultimate reference prior, since this quest has been going on for centuries, including the contributions of the French Polytechnicians Émile Lhoste and Maurice Dumas in the 1920s (Broemeling and Broemeling, 2003), with no indication that we are near reaching an agreement. The authors thus aim for a less ambitious construction.

Let us point out why we think this is an important problem. That we would have to change priors by changing parameters of interest is disturbing and somehow goes against the use of Bayesian methodologies. Ideally, one would want a single prior and various loss functions. Interestingly, this difficulty associated to the construction of noninformative priors – in the sense that it needs to be targeted on the parameter of interest – is amplified in large or infinite dimensional models. In finite dimensional regular models, the prior has an impact – at least asymptotically – to second order only. In infinite dimensional models, the influence of the prior does not completely vanish asymptotically, although some aspects of the prior may have influence only to second order. It has been noted recently that in a nonparametric problem, such as density or regression function estimation, nonparametric prior models may lead to well behaved posterior distributions under global loss functions such as the Hellinger distance for the density or the L_2-norm for the regression function while have pathological behaviour for some specific functionals of the parameter; see, for instance, (Rivoirard and Rousseau, 2012; Castillo, 2012; Castillo and Rousseau, 2013). This means that one needs to target the prior to specific parameters of interest, or that somehow it is asking too much of a prior to be able to give satisfactory answers for every aspects of the parameter. The larger the model, the more crucial the problem.

Obviously, it is of interest to derive priors which are *well behaved* for a large range of parameters of interest. The problem is then to define what well behaved means. This does not seem to be really defined in the present paper. Is it possible to derive a general notion of *well behaved* in the case of multiple parameters of interest without referring to a specific task or, in other words, to a specific loss function or family of loss functions?

The authors consider three possibilities: (1) a common reference prior existing for various parameters of interest which then should be used, (2) choosing the prior belonging to some parametric family of priors closest to the set of reference priors associated

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†Université Paris-Dauphine, CEREMADE and CREST – ENSAE, rousseau@ceremade.dauphine.fr

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