Report on "Bayesian restricted likelihoods: conditioning on insufficient statistics in Bayesian regression"

The paper has received a mixed reaction from the two referees and the AE. I have a similar reaction to the paper but agree with the other readers that the content is such that an opportunity to address the issues raised is appropriate. The AE's comments place the paper on the border between Reject with Resubmission and Major Revision. I mention this because it isn't clear that a revision will be successful as there are some significant criticisms in the reviews.

My concerns might be a little different than the others and perhaps are less technical in nature. It is generally agreed that *all* models are wrong. The incorrectness of the model can arise in a number of ways and some observations being outliers is one of these. The natural question then is: how are we supposed to deal with that? The answer is surely that we don't unless the discrepancy is so substantial that the inferences would be seriously in error if we proceeded using the assumed model. This part of a statistical analysis is the model checking aspect and the solution to any issue, whatever it might be, arises there. For example, for the problem being considered in this paper, I would want a model checking procedure that indicated that there is a serious problem because, no matter what distribution was used from the model, some observations are outlying and I would want the methodology to identify the observations in question. In that case there would several ways to deal with the issue, including modifying the model, but also simply discarding the offending observations as part of "data cleaning". It is worth noting though that the answer isn't simple because notable scientific achievements have been obtained by looking carefully at observations that are clearly discrepant.

So there are some concerns that have relevance for me and that I think the paper needs to address. What method is used to identify that there is a problem with the model such that the inferences will be strongly affected and does it identify outlying observations? A minor issue is that there may be no need to do modify the analysis but the major issue is that it introduces an arbitrariness into the analysis based on the need to choose T. The choice of T is clearly subjective and so it needs to be subjected to the same critical analysis that we would apply to the model itself and for that matter, the prior too, and it isn't clear how to do this. I understand that there are

problems where reducing the data to some $T(y)$ is necessary, perhaps because of computational problems associated with evaluating a likelihood, but this is clearly a compromised analysis and not one we would recommend unless forced to do so. So I don't agree with the statement made in the paper "that deliberate choice of an insufficient statistic $T(y)$ guided by targeted inference is sound practice". There needs to be a much stronger argument for this at least for me.

The paper is well-written and thought-provoking so my hope is that a revision will be able to address the points raised.