static algorithms, reinforcing our notion that overall MCMC efficiency is highly dependent upon hierarchical model structure, and attempting to infer what might be an efficient MCMC algorithm for a particular problem is, in general, difficult.

5 Discussion

We have presented a general automated procedure for determining an "efficient" MCMC algorithm for hierarchical models. Our procedure is a greedy, iterative algorithm, which traverses a finite and well-defined set of MCMC algorithms. This is the first such automated MCMC-generating procedure of its kind, so far as we are aware. Using a suite of example models, we have observed that our automated procedure generates improvements in efficiency (relative to static MCMC algorithms) ranging between one and three orders of magnitude. In each case, the automated procedure produced an MCMC algorithm at least as efficient as any model-specific MCMC algorithm making use of prior knowledge or expert opinion. In all examples, our iterative procedure terminated within four iterations, although it is plausible that for more complex models it would proceed longer.

Our study has been confined to a single dimension of a much broader problem. We have strictly considered combinations of scalar and blocked adaptive Metropolis-Hastings sampling, with a small number of exceptions only for the purpose of comparison (*e.g.*, the use of conjugate sampling). No less, we have restricted ourselves to non-overlapping sampling: each model parameter may only be sampled by a single MCMC sampler function. We may instead view the domain of our problem (automated determination of an efficient MCMC algorithm) as a broader space of MCMC algorithms. This space may permit a wide range of sampling algorithms not considered herein: auxiliary variable algorithms such as slice sampling (Neal, 2003), or derivative-based sampling algorithms such as Hamiltonian Monte Carlo (Duane et al., 1987), among many possibilities. The resulting combinatorial explosion in the space of MCMC algorithms makes any process of trial-and-error, or an attempt at comprehensive exploration, futile. It is for this reason we seek to develop an automated procedure for determining an efficient MCMC algorithm, which may not be globally, maximally efficient, but provides non-trivial improvements in efficiency, nonetheless.

It should be noted that aspects of the problem addressed herein superficially resemble, but