Research Proposals: Design and Methods

The "Design and Methods" section of a research proposal summarizes the experiments that you plan to perform. Again, most proposal templates don't permit you much space (a page or two), so you must summarize instead of elaborate. A typical organization for this section is as follows:

- **Overview**. Provide a good introductory paragraph about your experiment.
- **Methods and Materials**. Explain your technique and the experimental tools you'll need. Where appropriate, identify any techniques pioneered by others. If you are proposing a multipart experiment, summarize each of the major parts.
- **Data Analysis (or Evaluating Results)**. Describe the statistical tests your team will apply to the data. Explain why your chosen method of analysis is appropriate.

For example, consider the following experimental "Design and Methods" section:

Design and Methods (sample)

Our algorithm breaks down the interaction of hurricane and environment into a series of 15-minute "steps." After each step, our program examines deltas in both the hurricane's three-dimensional shape and in the surrounding environment. The algorithm models this pas de deux, readjusting the dance floor after each move.

Methods and Materials. Our team will evaluate environmental data provided by the National Hurricane Center (NHC) from 1992 to present. (Data sets prior to 1992 do not contain enough detail for our purposes.) These data sets are very large and require a tremendous number of floating-point calculations ($\sim 10^{15}$) to compute a single 120-hour forecast. To handle this load, we require an 8-CPU server with 8 GB of RAM.

We plan to write approximately 1.2 million lines of C code and to take advantage of approximately 3.5 million lines of existing public-domain C code.

Data Analysis. The NHC currently uses a simple standard metric for determining the accuracy of predictions. Every six hours, they measure the distance between the actual and predicted positions of the storm. The mean of these measurements yields the accuracy of the forecast program. To ensure meaningful comparisons, we will use this standard accuracy metric as well.

As Zeven (2001) notes, seasons in which storms move slowly yield greater projective accuracy, even without any actual improvement in diagnostic programs. Therefore, we will also supply a second metric that factors in the speed of each storm.