

How to write a proposal:

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Any proposal is supposed to allow the reader to judge what the research goals are and how they relate to other relevant work, whether the research is worthwhile, whether the project is feasible, whether the author is able to carry them out, and whether there is a realistic, feasible timetable for carrying out the project.

As an example of a proposal organization, take the format for project proposals that is standardly used when applying to the Office of Naval Research and other governmental funding agencies. Such a proposal has 8 sections, three of which are irrelevant for student proposals.

1. Background
2. Research Problem
3. Technical Approach
4. Milestones
5. References
6. Budget (irrelevant)
7. Facilities statement (irrelevant)
8. Vitae of principal investigators (irrelevant)

1. *The Background Section* reviews prior work in order to accomplish three goals:

- To familiarize the reader with concepts needed to understand the rest of the proposal.
- To show that the proposed work hasn't yet been done.
- To demonstrate the author's familiarity with the relevant literature and research background.

2. *The Research Problem Section* states the question that your work will answer or the technical problem that it will solve. The most common bug in proposals is failure to provide a clear statement of the research. Using the background that is created by the first section, begin this section with a clear, well focused formulation of the problem.

Of course, any research project will involve unsolved problems; you will not have all the answers until you have carried out the research. But unless you know what questions you are asking, and can communicate them effectively in writing, you are still at the pre-proposal stage of more or less unfocused confusion. The proposal has to show that you are clear about your research goal, and have a plan that is likely to solve the remaining problems that will come up along the way.

At the pre-proposal stage, you may need help. Don't hesitate to meet with faculty who can help you. Try your ideas out on other students. Conversations with experts are the most helpful way to hone your ideas. Conversations with nonexperts are a good way to hone your exposition. Seek criticism wherever you can find it, and take advantage of it when you find it. Self-criticism is one of the most important components of research expertise; the best way to learn this skill is to seek criticism from others.

It is time to begin writing the proposal when you have clarified the problem and are planning the further research steps that will lead to its solution. (Of course, a clear formulation of the problem does not mean that the project will withstand further scrutiny; it may turn out to be infeasible, or to have been done already by someone else.)

Proposals to funding agencies usually not only state a research problem, but go to some pains to point out how the world will benefit if the problem is solved. This sort of motivation is not as important in a student project proposal, and may not even be appropriate, since projects that are feasibly scaled for many sorts of pre-dissertation projects are too small to be influential on the future course of AI, or to be useful for technology transfer. However, some motivation is appropriate even for such projects. It is not enough to say "I'm going to do X because it hasn't been done before"; many things that have never been done are not worth doing. Usually it is possible to point out briefly how a project could be extended incrementally in a way that would result in progress in some area of AI. The more advanced your project, the more important this motivation becomes.

3. *The Technical Approach Section* is where you describe what you will do, focusing on the major design decisions. This section should not only provide an overall design, but give a clear picture of the chunks of work that are involved.

It is in this section that software engineering considerations enter into the picture. This includes not only the design, but requirements analysis, data gathering and knowledge acquisition, and testing and evaluation. In all cases, show that you are in control of the relevant technical material. For instance, if human factors are involved, show that you know the relevant psychology; if you plan to test your system in a way that will use statistics, show that you know the relevant statistics.

Together with the following section, this should make a convincing case for the feasibility of the project, given the available resources.

4. *The Milestones Section* redescribes the work as a schedule, providing a list of major subgoals and time estimates for achieving them. This section can simply be a list or table, especially if all the major subgoals have already been mentioned in the Technical Approach section.

Bear in mind that an important professional skill in AI is knowing how much time and resources it will take to achieve a goal, and that meeting deadlines on time is critical in this profession.

5. *The References Section* is simply the bibliography for the stuff you cited in the preceding sections. It should show that you know the relevant literature.