

Guidelines for Acoustic Research Projects

The goals of this research project are a) to become familiar with sound analysis methods, and b) to practice the scientific method. Practicing the scientific method means identifying an interesting question, formulating testable alternative hypotheses, collecting data that permits testing these hypotheses, analyzing the data, and presenting your results. In short, you will be doing science yourself, with its attendant joys and sorrows, rather than simply learning about the results of others.

One aspect of modern science is that it is often collaborative, with many people working together on different aspects of a project. You will also work collaboratively on this project in groups of 4 students each.

In this project you will be focusing testing hypotheses relating to a given set of animal sounds. These probably will be sounds that are already recorded and digitized by another researcher, although it is certainly possible for you to record your own set of sounds if you wish. Below I list a series of sound sets that I have identified with a brief description of the sounds and the e-mail of the researcher. Please be respectful of the researcher's time when requesting these sounds and remember they are doing us a big favor by agreeing to provide the sounds. Give them plenty of lead-time for providing the sounds and any accompanying information!

There will be two parts of the project that will be graded. The first is a project proposal, in which you provide a justification for the research with reference to previously published work, outline your hypotheses, and detail how you will test them. The second part of the project will be public oral presentations in which you present the results of your work and discuss their implications. This task is one of the most challenging faced by a scientist, but it is a critical ability. The project proposal is worth 15% of your final grade and the presentations are worth an additional 10%.

Project Proposal (due March 31 by 5 PM in room 2223 BP)

Before completing your analysis each group must write a 5-page project proposal outlining the project. The proposal should contain the following four sections: Introduction, Proposed Work, Discussion and References. The Introduction will state at least one question to be investigated. Examples of possible questions are: 1) Do individuals exhibit individual differences in call features? 2) Are there differences in call features between different habitats or times of day or different behavioral contexts? 3) Do individuals of different genetic background or developmental regimes differ in call characteristics? 4) Are animals using certain call characteristics more successful in mating or holding a territory than others? You will need to put this question into context by citing at least five references from the primary literature. Note that while journal articles qualify as primary literature, web sites do not, and thus will not count towards your five primary references. The Introduction should also contain at least two hypotheses as possible answers to the question, one of which can be a null hypothesis (i.e. no differences exist)

The bulk of your proposal should consist of Proposed Work. The Proposed Work must explain how sounds will be obtained, i.e. explain in as much detail as possible how the sounds were (or will be) recorded and specify the equipment used, if known. The methods of analysis need to be explained. The details of the methods can be chosen by each group, but each project must include at least one example of each of the following types of analyses: amplitude measurement from a power spectrum, frequency measurement from a spectrogram, and a duration or rate measurement from a waveform. All measurements should be done in Raven unless other methods are previously approved by the instructor. Each project should plan to include measurements from 50-100 calls, although these do not have to be done for the written proposal. Make sure to indicate clearly how you plan to test your hypotheses using the measurements you plan to collect. For example, to test for individual differences you will need to plot the average measurements for each individuals, and ideally use an appropriate statistical test to test for significant differences. Such an analysis could be done for multiple acoustic measurements. Research papers pertaining to your specific subject are an excellent source of ideas for appropriate measurements and analyses. I suggest examining some of the sound-oriented discussion papers and references therein for ideas.

In the Discussion, you should describe the possible outcomes of your analysis and briefly indicate how you will interpret the results given each outcome. If appropriate, you might also want to mention additional analyses that could be done in the future depending on what you discover. Suggestions of additional analyses provide an opportunity for you to demonstrate your understanding of the methods being used.

The References cited must include complete bibliographic information on the primary references you cited in your proposal. Cite papers as (Smith, 1999) in the proposal and use the following convention for your Reference section:

Smith, P.U. 1999. Excess body odor repels prospective mates. *J. Appl. Chem.* 45: 34-36.

Students in a group are encouraged to work together to develop their hypotheses and experimental methods. Groups can submit a single proposal in which case everyone will receive the same grade. Please also see the section on academic honor in the syllabus and consult with me if you have any questions about what constitutes appropriate usage of the scientific literature.

Project presentations (May 5, 10, and 12 in class)

In the last three class meetings we will have public presentation of your research projects. These should roughly follow the form of your proposals, except that in the presentations you will have finished your measurements and analysis and be able to discuss actual results. Specifically, the presentations should have an Introduction in which you a) give the background to the general question at hand, including previous research on the subject, b) describe your specific research question, and c) present and justify your

hypotheses. Next should come a brief Methods section, which can be interspersed with the Results section if you wish. Combined, these sections should occupy about half your talk. You should end with a discussion of the significance of the results, again referring to your hypotheses and previous work in the area, and including a bit on possible future work. Don't forget to acknowledge anyone who helped in your research, including those who gave you the sounds.

Presentations should last 15 minutes with 5 additional minutes for questions. All group members should participate (i.e. speak before the audience). I recommend using Powerpoint for your presentations, although other forms of demonstration are welcome. Creativity in presentation style is encouraged, as long as it enhances the communication of your results. You should practice your presentation together to make sure you are able to present everything in the time allotted.

Sounds for Group Projects

You should visit the Useful Web Sites link on this website to see if there are any recordings that you could use for your project. You are also welcome to use your own sound files or make your own recordings. I am willing to let you borrow recording equipment if you would like to make your own recordings.