Statistics 5303
Fall 2013

Project

Read Chapter 20. It includes a framework for the design of experiments process. This framework includes some topics that we have not yet covered, but much will be usable to you already. Section 20.3 briefly describes a project, and that's our topic here.

I want each of you to design, run, analyze, and report on an experiment. This project is 25% of your course grade. If you are already engaged in research and can set up an experiment that works for this class and your research as well, that's great; I don't mind the double dipping. However, it should be an experiment that you design for the project, not an experiment that you (or someone else) ran before. Subject matter, hypotheses, treatments, and so on are at your discretion. This experiment should not be huge or expensive (certainly we can't give you any monetary support and you don't have that much time to do it), but it should have enough treatments and/or factors to make it interesting.

Important! Note: Any experiment that you do for this class is subject to University rules and to review by the University's Institutional Review Board. In particular, this means that any experiment involving humans or animals as subjects is subject to review. See `http://www.irb.umn.edu` for the University's rules on Protecting Human Subjects. Because we are doing independent projects, I cannot obtain a blanket approval; any project that uses human or animal subjects must obtain IRB approval, and you must have received training in the responsible conduct of research as part of the criteria to obtain approval. This approval is not instantaneous, and if you don't already have approval, it is probably already too late. Experiments like the brownie and vision experiments described below do not need IRB approval so long as you, the experimenter, are the only evaluator or person whose vision is being tested and the experiment is benign.

Important! Note: you need to run an *experiment,* not an observational study.

Here is the time line. First, you should turn in a Project Proposal by November 8. You may want to look ahead to see if later design tools may be useful. I will read the proposals, make comments and/or suggestions, and return them as quickly as possible. Then go do your experiment, analyze it, and write a report on the results. (I would like your raw data attached as an appendix if possible.) There is a partial draft report due on November 27. This partial draft report should include sections on background, motivation, and design of the experiment; you can include more if more is ready, but it should have those components. The final Project Report is due December 11, so you have roughly a month to complete the experiment and the write up. That's not a lot of time, so you will need to manage the size and scope of these experiments carefully.

The report should begin with a section that motivates the problem. Next you should have a section describing your experiment, including treatments, units, responses, randomization, and so on. This is essentially the "materials and methods" section found in most scientific papers. Next comes a results section. This should be like the data analysis sections on the homework and exam solutions. Note that this is much heavier on the statistics than would be typical in a scientific paper (but hey, this is a statistics class!). Finally, you need a conclusion. All of this should be written as a paper; you will be penalized for poor writing or unannotated computer output. You can put any needed output into an appendix. Also, please append the raw data if possible.

Here are some topics from your predecessors. Some of these were run just for this class, and others were run as part of an ongoing research effort. Experiments marked with a * used human or animal subjects and required institutional approval.

- Rate of Advance of Slinky Toys Down Inclined Planes as a Function of Plane Angle and Size and Type of Slinky.

- The Role of Chocolate Chips, White Chocolate Chips, and Nuts as Enhancements in Packaged Brownie Mixes.
- Target and Background Color Affect Night-Vision Acuity.
- Soil Temperature, Moisture, and Compaction Effects on the Sprouting Success of Snapdragon Seeds.
- Effects of addition of salt and burner size on boiling times of water.
- The effects of pan type, fat type, covering, and sugar addition on the carmelization of onions.
- The effects of water/rice ratio and cooker brand on rice stickiness.
- Effects of enclosure and brand on candle longevity.
- How laundry detergent characteristics and washing strategies affect stain removal.
- A comparison of long-wearing and permanent lipsticks.
- Strength of notched beams.
- Effects of language and word list on color naming speed.
- Effects of preservatives, water changes, and trimming on the longevity of long stem roses.
- Effects of light level, watering frequency, and fertilizer use on the growth of grass seedlings.
- *Metabolism of opioid analgesics in mouse strains bred for sickle cell disease.
- Effects of temperature and mixing on cheese meltability.
- Optimization of parameters for the polymerase chain reaction of the primer HrU2 for use in the Barn Swallow (*Hirundo rustica*).
- Reliability of gas chromatography for determining breakdown of poly-hydroxybutyrate.
- The rheology properties of beta-glucan in processed cheese spread.
- *Interspecific interactions between brown trout and slimy sculpin in Valley Creek, Minnesota.
- *Effects of expectations of perceived power in social situations.
- Effects of management treatments on native prairie vegetation.
- Effects of chemical treatments and pulping time and temperature on the lignin content of paper pulps.
- The effect of predation risk and hunger level on milfoil weevil foraging behavior.
- Effects of process, component, and test method on flat pad failures on ball grid array solder joints.
- Effects of brand and temperature on the viscosity of yogurt.
- *Does media coverage of advertisements affect public perception of political campaign tone?
- Effects of pan type and kneading time on the volume of bread loaves.

- Effect of concentration, time, and calibration of sodium butyrate on the specific productivity of antibodies in Chinese hamster ovary cells.
- Effects of storage temperature and cooking length on the number of unpopped kernels of microwave popcorn.
- Variation between two methods of nitrogen analysis on determining protein degradation characteristics.
- *The role of sensory specific satiety in the desirability of different flavors of potato chips.
- Moisture meter accuracy and precision on solid aspen and oriented strand board with two types of meters.
- *Effects of age and contextual interference on linear arm movement.
- Effects of moisture on the hardness of potato chips.
- *Perception of gender, handedness, and writers' use of nondominant hand from written samples.
- Factors affecting the height of corn muffins.
- How soil type and fertilizer level affect bean-leaf width.
- Effects of ball type and temperature on the bounce heights of rubber balls.
- Resistance to different antibiotics among bacteria in waste water.
- Effects of soldering and stimulation frequency on capacitance.
- Effects of design and paper type on the flying distance of paper airplanes.
- Effects of washing and container type on the browning of apple slices.
- Effects of powder type and charge level on the precision of bullets.
- Effects of dough type and temperature on the chewiness of chocolate chip cookies.
- Use of partially burned trees in oriented strand board.
- Flight distance of foam darts.
- Effect of temperature treatments on Latex stiffness.
- Settling of reconstituted orange juice.
- Effect of temperature on perfume longevity.