

12: Logic and Decision Making

Christian Wüthrich

Fall 2007

Class schedule: TuTh 5:00-6:20pm, Pepper Canyon Hall 109
Sections: A01: M 8-8:50am, York 4080A (TA tba)
A02: M 4-4:50pm, York 4080A (TA tba)
A03: F 8-8:50am, Warren Lecture Hall 2113 (TA tba)
A04: F 1-1:50pm, Warren Lecture Hall 2113 (TA tba)
Website: <http://philosophy.ucsd.edu/faculty/wuthrich/>
Contact: Office hours are Mo 1-2, Th 2-3
Room 8047 HSS ☎ 858-534-6548 ✉ wuthrich@ucsd.edu
TA: Lisa Damm (Office hours: Mo 2:45-3:45pm and Tu 3:45-4:45pm)
Room 8089 HSS ✉ ldamm@ucsd.edu
Daniel Schwartz (Office hour: We 3:30-4:30pm)
Room 8073 HSS ✉ d1schwar@ucsd.edu

This class offers a systematic introduction into the principles of reasoning and decision making. The importance of understanding these human activities can easily be seen in cases where we don't apply these principles in the best manner. One of the contexts in which humans have most systematically and most successfully developed their capacities for good reasoning is scientific inquiry. This is where we will turn for guidance. Hence, we will try to understand how science works and how reliable its results are.

Some of the questions we will address are the following:

1. What are the principles of good reasoning in science?
2. Can we ever be absolutely certain of the truth or falsity of a scientific hypothesis? Of a hypothesis not from science?
3. How objective is observation? How can we avoid making mistakes in perception?
4. What are the kind of things we might learn from systematic observation? And what not?
5. What can we infer from discovering correlations between variables? How can we avoid being misled by illusory correlations?
6. What does it take to establish a causal relationship?

The participants in this course are expected to actively engage in the kinds of reasoning and decision making that scientists use in testing hypotheses. Much of the active engagement will be through online exercises and demonstrations. Our goal will be to understand the logical and statistical principles by which scientific claims are formulated and evaluated. We will attempt to develop a critical appreciation for the methods by which knowledge is acquired in science. You should leave this course with an improved ability to distinguish good from bad reasoning and decision making in science and in everyday life.

Course materials

All course materials can be found on the inquiry web site at <http://inquiry.ucsd.edu>, developed by Bill Bechtel, Adele Abrahamsen, Carl Craver, and Peter Bradley. Login direction and initial login codes are included in the course reader, which is available at the UCSD bookstore. The modules found on the website include text, demonstrations, and interactive exercises, of which only the text is included in the course reader. Some modules have questions to answer at the end. You *must* complete the interactive exercises and answer the online questions in order to pass the class. All activity on the site is recorded and logged, including answers to question sets attached to the modules. Completion of the online exercises is a requirement of the course.

Apart from the course package, you will also need to purchase a transmitter for the **InterWrite PRS RF System**, the student response system used in this class. These transmitters, informally called “clickers,” are also available at the UCSD bookstore and cost \$46.70 (new) or \$35.05 (used). You may be able to use the same clicker in other classes, particularly in science classes. Make sure to get a new clicker operating at radio frequency and not an old infrared one.

Course requirements and evaluation

For each module, students are expected to complete the module and any questions attached to it **before** attending the class for which it is assigned. **Attendance in class and sections is required.** The final grade for this course will be determined by the total points a student earns from the five types of evaluation indicated below. Expect a **D-** for a total of 60 points, a **C-** for a total of 70 points, a **B-** for a total of 80 points, and an **A-** for a total of 90 points. This scale may be adjusted according to the point distribution in the class. If you take the class for a Pass/Fail grade, you must have at least a **C-** in order to pass the class.

1. *Participation* (15 points): participation will be measured using the InterWrite PRS RF student response system. During each class (except the first), I will ask you to “buzz in” and the system will automatically record your responses, and then transmit it to me. Perhaps twice or so during classes, I will put up a short quiz or poll for you to answer. For participating in these small quizzes and polls, you will receive one point per class meeting if you click in each time I prompt you to, half a point for responding to some of the prompts during this class and none if you never click in. You can accrue points for participation up to a maximum of 15 points, i.e. 15 classes out of 19 (not counting the first). **Important: you must have your clicker every class period to get these points—no exceptions.**
2. *Midterm exam* (25 points): there will be a **midterm exam** in class on 25 October 2007.
3. *Final exam* (35 points): there will be a **final exam** on Friday, 14 December 2007, 7:00-9:59pm. I am sorry about the timing, but this is unfortunately beyond my control. The final exam is cumulative, i.e. it covers all the material of the entire course.

4. *Short papers* (20 points): two short paper assignments of 1 to 2 pages will be given.
5. *Interactive exercises* (10 points): you can earn these points by completing the web-based exercises and questions in a timely manner.

As you see, you can obtain a maximum of 105 points. Since a point corresponds to a percentage point, you will be able to get five “extra” percentage points.

The fine print

You must observe the University’s Policy on Integrity of Scholarship, which can be found at <http://www-senate.ucsd.edu/manual/appendices/app2.htm>.

Make-up exams (for midterm and final) will only be given under the most severe circumstances. The student who wishes to write a make-up exam must inform me (by phone or email) ahead of the time of when the exam is due (midterms) or takes place (final). In order to qualify for a make-up exam, appropriate evidence of the most severe circumstances must be produced by the student. I will determine, in consultation with the student, what qualifies as appropriate evidence.

Tentative schedule of classes and web assignments

You should complete module readings, including any attached questions, before the assigned class. Copies of PowerPoint presentations are available online. These are slightly revised slides that were originally authored by Bill Bechtel, whose generosity in sharing them I gratefully acknowledge.

Date	Topic	Web site modules
<i>27 Sep</i>	Introduction: web site and clickers	
<i>2 Oct</i>	Elements of science	Invitation to scientific reasoning Statements: the atoms of reasoning Justification and arguments
<i>4 Oct</i>	Valid arguments	Some basic valid argument forms
<i>9 Oct</i>	Confirmation, falsification, and fallibility	Evidential relations The fallible character of human knowledge
<i>11 Oct</i>	Observation and categories	Observation and learning to see
<i>16 Oct</i>	Categorizing phenomena	Categories and taxonomies
<i>18 Oct</i>	Observational research	Observational research
<i>23 Oct</i>	Distributions and samples	Variables and measurement
<i>25 Oct</i>	Midterm exam in class	
<i>30 Oct</i>	Predicting relationships between variables	Predicting relations between variables
<i>1 Nov</i>	Predicting from correlations	When variables are correlated
<i>6 Nov</i>	Differences between means	When variables are not correlated When groups differ
<i>8 Nov</i>	Correlation and causation	Correlational studies as tests of causal claims Correlational vs. experimental research
<i>13 Nov</i>	Causal explanation First short paper due	Causal explanation
<i>15 Nov</i>	Reasoning about and graphing causes	Reasoning about causation Causal reasoning with directed graphs
<i>20 Nov</i>	Causality and experiments	Testing causal claims experimentally
<i>27 Nov</i>	Causation when experiments are not possible	When randomized experiments are not possible
<i>29 Nov</i>	Mechanism and mechanistic explanation Second short paper due	Entities and activities organized to produce a phenomenon
<i>4 Dec</i>	Levels of organization	Levels of organization within mechanisms Describing and portraying mechanisms
<i>6 Dec</i>	Discovering and modeling mechanisms	Experimenting on mechanisms Denying phenomena when mechanisms cannot be conceived
<i>14 Dec</i>	Final exam , 7:00-9:59pm	