Sample Handout (Epistemology of Experiment)

Observation and Scientific Realism
Hanson, *Patterns of Discovery*, Chapter 1

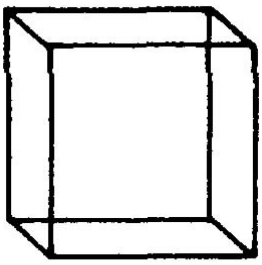
1. What is perception (seeing)?
What does it mean to see? What is it that we perceive?

Standard philosophical position: Perception is becoming aware of something.
Sense data theory (standard form):
i) sense data are the things we're directly aware of: one side of the tomato
ii) sense data depend on the perceiver's mind: mental images, ideas, percepts
iii) sense data have the properties we perceive: the image of the tomato is red

Arguments for Sense Data:
Perspectival variation: Our perceptions change with lighting, distance, but the object doesn't change. What we're directly aware of can't be the external object.
Illusion: We can be fooled by illusions (a straight stick looks bent in water), so what we're directly aware of in perception can't be the real, physical object.
Others?

Alternative positions:
Direct realism: We perceive physical phenomena themselves, not something mind-dependent.
Adverbialism: When we look at a tomato, we perceive redly. There need not be something red that is perceived.
Others?

2. Does perception involve thought or interpretation?
What changes when the Necker cube flips? Do you do something in addition to seeing when you see it as a box?
"To interpret is to think, to do something; seeing is an experiential state"



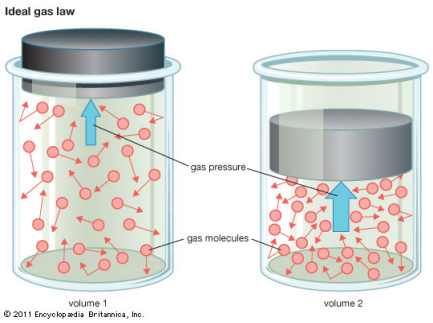
Group Discussion Questions:
What is the difference between perception and thought? Are they distinct?
If there is no distinction between thought and perception, how is it that we can make objective observations?

3. How does knowledge affect perception?
How does what you know or think you know affect perception?
Hanson assumes thought is linguistic in nature. Are thoughts like sentences?

Hanson compares the disagreement between Tycho Brahe and Kepler to differences in visual interpretation. Were they just interpreting their visual perceptions differently? Is this like flipping the Necker cube?
What does Hanson mean by "seeing is a 'theory-laden' undertaking"? What is the theory here?

Hacking: Experimentation and Scientific Realism

The "Stanford School" challenged the role of THEORY in science. Hacking argued that EXPERIMENT had been neglected.



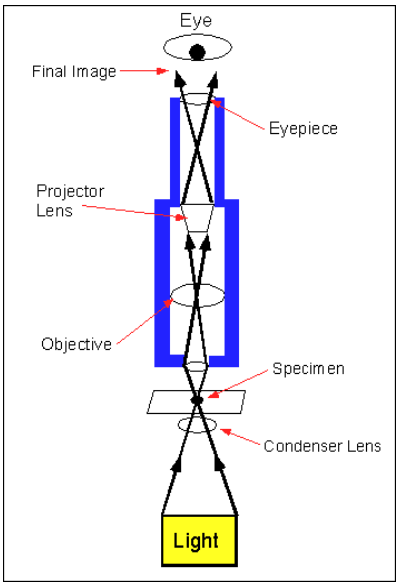
The DN (deductive-nomological) Model of Explanation:

Theoretical Law :	$PV = nRT$
Observation Statements:	$P = 5x10^5$ Pa, $V = 1$ m^3, $n = 100$
Theoretical Constant:	$R = 8.314$ J / K mol
Deduction:	$T = 328$ C

Realism (about theories):
Questions: What are some reasons for being skeptical about the truth of scientific theories? What does "inference to the best explanation" mean?

Realism (about entities):
"The experimenter is convinced of the existence of plenty of 'inferred' and 'unobservable' entities. But no one in the lab believes in the literal truth of present theories about those entities. Although various properties are confidently ascribed to electrons, most of these properties can be embedded in plenty of different inconsistent theories about which the experimenter is agnostic." (Hacking, 1981)
Questions: Is this a realistic picture of scientific practice? If true, what does this do to the arguments against theory realism? What is the problem of incommensurability?

"Don't just peer: interfere"
"We stain the specimen, slice it, inject it, irradiate it, fix it. We examine it using different kinds of microscopes that employ optical systems that rely on almost totally unrelated facts about light. Microscopes carry conviction because of the great array of interactions and interferences that are possible." (Hacking 1981)
Questions: Is it the interference that makes us believe what we see with a microscope, telescope, X-ray machine, fMRI machine? Isn't visualization important?



"If you can spray them, they're real"
The point of the PEGGY II experiment: demonstrating parity violation in weak neutral current interaction. Hacking's point: an example of why we believe electrons are real.

Group Discussion Questions: Is this true of other examples, or in other sciences? Are there other types of arguments for the reality of entities?