Announcements and Such

- One Song — Yes, Classic Yes
  - *I've Seen All Good People*

- No office hours for Branden today
- Essays to be returned next week
  - Tuesday after class
- Today: Inference and the Extension of Knowledge II
  - This is where we start getting into some serious theoretical *epistemology*.
- Next time: Part I of three parts on the Architecture of Knowledge (*very* serious theoretical epistemology)

Inference and the Extension of Knowledge
Deductive and Inductive Inference (Review)

- A *deductively valid* argument (from premises P to conclusion C) is such that it is *impossible* for P to be true and (at the same time) C to be false.
- An *inductively strong* argument is one such that the *probability of C, given P,* $\Pr(C \mid P)$, is *high*. Precisely, this means that $\Pr(P \& C) \approx \Pr(P)$.
- There are various kinds of inductive arguments:
  - Analogical arguments
    - a is similar to b. *Fa*. Therefore, *Fb*.
  - Abductive arguments
    - H is the best explanation of E. E. Therefore, H.
  - Generalizational arguments
    - *Fa* & *Ga*. Therefore, all *F*'s are *G*'s.

Inference and the Extension of Knowledge
Inferential Transmission of Justification & Knowledge I

- Audi distinguishes *deductive* and *inductive transmission* of justification and knowledge.
- Let's think about justification first. He suggests that deductive transmission of justification requires that the underlying argument be *valid*.
- But, one of his examples is a bit puzzling. He suggests that if one *takes oneself* to be reasoning deductively, then the underlying inferential structure must *be* a *deductively valid* argument.
  - But, why isn't the proper necessary condition here being *justified in believing that* the underlying inferential structure is valid?
  - After all, we're just talking about justified belief here, *not* knowledge. I found this puzzling.
  - We say this about *testimony*, for instance…

Inference and the Extension of Knowledge
Inferential Transmission of Justification & Knowledge II

- And, what if the argument I'm relying on *is* valid, but I am justified in believing that it is *not* valid?
  - Why *not* say this *doesn't* transmit justification?
- It seems to me that this condition should be:
  - Deductive inferences (*i.e.*, inferences *S takes to be deductive*) transmit justification *only if S* is justified in believing that the inference is valid.
- Note: this is a *necessary* (*not sufficient*) condition!
  - I write a long (non-fiction) book. I am justified in believing each claim I make in the book *P1*, *P2*, *P3* … And, I (*knowingly*) *validly infer* their conjunction *C* = *P1* & *P2* & *P3* …. I also have very good reason to believe that *all long books contain at least one false claim*. Here, I could *fail* to be justified in believing *C*.
- *Sufficient* conditions are *very hard* to come by…

Inference and the Extension of Knowledge
Inferential Transmission of Justification & Knowledge III

- Now, let's discuss inductive inference & transmission (we'll come back to deductive inference again later).

- Inductive inference is much trickier, because it is *defeasible* (more precisely, it's *non*-monotonic).

  - If *P* entails *C*, then so does *P* & *K*, for *any K*.

  - But, Pr(*C* | *P*) can be *high*, when Pr(*C* | *P* & *K*) is *low*.

  - Example: *C* = John will not get wet, *P* = John will be dropped (gently, by helicopter) onto the middle of Lake Mendota (in Madison, WI) in early February.

  - Here, Pr(*C* | *P*) is high (the lake's usually frozen).

  - But, *K* = the lake is not frozen this year.

  - Now, Pr(*C* | *P* & *K*) is *very low*!

- Non-monotonicity is a *crucial* feature of induction.

Inference and the Extension of Knowledge
Inferential Transmission of Justification & Knowledge IV

- When people make inductive inferences (from *P* to *C*), they believe lots of things (*K*) besides *P*.

- One needs to make sure that one's *background K* doesn't *defeat* the inference. Here's a condition:

  - Inductive inferences (*i.e.*, inferences S *takes to be inductive*) transmit justification *only if S* is justified in believing that Pr(*C* | *P* & *K*) is high, where *K* is *S*'s total (background) evidence.

- Audi suggests that not all of *K* will be "relevant" to the assessment of the strength of any given argument. I don't see what his point is here.

- If there is some *part* (*Z*) of *K* that is "the relevant part of *K*", then Pr(*C* | *P* & *K*) = Pr(C | *P* & *Z*), in which case including *all* of *K* will do no harm.

- If Pr(*C* | *P* & *K*) ≠ Pr(C | *P* & *Z*), then we *need K*!

Inference and the Extension of Knowledge
Inferential Transmission of Justification & Knowledge V

- There is a related complication concerning deductive *vs* inductive reasoning: *chains.*

- With deductively valid arguments, arbitrarily long chains of valid arguments will transmit.

- But, with inductive arguments, long chains can (eventually) fail to transmit (although, Audi does not do a very good job of *explaining why*).

- Consider a chain of inductively strong arguments

$$A \xrightarrow{r} B \xrightarrow{r} C \xrightarrow{r} D \cdots$$

- Even though Pr(*B* | *A*) > *r*, Pr(*C* | *B*) > *r*, *etc.*, we could have Pr(*C* | *B* & *A*) < *r* or Pr(*D* | *C* & *B* & *A*) < *r* (*etc.*) which could lead to failures of transmission.

- The problem is: *we need to add each thing we infer along the chain to K for all subsequent inferences.*

Inference and the Extension of Knowledge
Inferential Transmission of Justification & Knowledge VI

- *Knowledge* behaves differently (first, *induction*).

- It seems that knowledge *can* be transmitted, even through inductive inference, and even if some justification/probability is "lost in the inference".

  - You *know* the weather is bad and you infer that Jane, who is driving, will be late. Presumably, you *could know* the latter proposition on the basis of the former *even though there is some chance that she left early and compensated for the weather.*

- Moreover, knowledge can *fail* to be transmitted even when the probabilities are *very* high.

  - You *know* that you hold one of a million tickets in a fair lottery, which will have one winner. You infer — *with very high probability* — 0.999999, that you will lose. You do not *know* you will lose.

Inference and the Extension of Knowledge
Inferential Transmission of Justification & Knowledge VII

- We have seen that *justification* can fail to be transmitted, even through (known) deductively valid inferences. What about *knowledge*?

- This is much more controversial. We will discuss this more in the skepticism section (at the end).

- Some say that knowledge needn't be transmitted through (known) deductively valid inference.

  - We're at the zoo. I ask: what's that thing in the exhibit? You say (*P*) it's a zebra. I ask: do you *know* it's a zebra? You say "yes". I ask: do you know (*C*) it's *not* a very cleverly disguised horse? You say "no".

- Some people think this is a *counterexample* to the **Deductive transmission principle for knowledge**: if you (knowingly) validly infer *C* from an a *P* you know, then you know *C*.

Inference and the Extension of Knowledge
Inferential Transmission of Justification & Knowledge VIII

- One might reply to such examples, as follows:

  - Because one *now realizes* that one's basis for believing *P* might not have been decisive, one *no longer* knows it, yet *did* know it in the first place.

  - Once the (skeptical) challenge (that it might be a very cleverly disguised horse) is raised, you *no longer know* that it's a zebra, but you *did* before.

- If so, this shows something important: sometimes *reflection on* our grounds can bring into our purview considerations that *weaken* them or at least weaken their power to support inferences.

- This is an important feature of such examples, and it will be a central aspect of skeptical arguments.

- We'll talk a lot more about this later on…

Inference and the Extension of Knowledge
Inferential Transmission of Justification & Knowledge IX

- Although unqualified (naive) principles of deductive transmission are false, *qualified* versions seem OK:

- **Qualified deductive transmission principle for justification**: Typically, (known?) valid reasoning from justified *P* transmits justification to its *C*.

  - This holds for overall justification (as well as for *some* degree of justification), but it allows for some degree of *diminution* across the inference.

- **Qualified deductive transmission principle for knowledge**: Typically, (known?) valid reasoning from known premises transmits knowledge to its conclusion. (where the conclusion belief is based on the premise belief(s), as would be normal).

- Notice how I have (parenthetically) asked "known?" in these. **No**! This can lead to a dangerous regress …

Inference and the Extension of Knowledge
Inferential Transmission of Justification & Knowledge X

- You probably noticed that Audi does not state any (even qualified) principles for inductive transmission.

- He *tentatively* asks whether this one is reasonable:

  - **Inductive transmission principle**: If, by good inductive reasoning, one infers something (*C*) from premises (*P* & *K*) which take account of all the relevant evidence, then if one is justified in believing those premises, one is justified in believing the conclusion.

- He points out that *some degree of justification* is *normally* transmitted. Even in the lottery case, some *degree* of justification is transmitted by the inference. But, in the preface case, *even this* is not so clear.

- Audi doesn't claim that (even *normally*), *full justification* is transmitted by "good" inductive inferences.

- It *often* is, but it's harder (than *deductive*) to say *when*.

Inference and the Extension of Knowledge
What the Tortoise Said to Achilles I

Achilles and Tortoise are discussing Euclid's argument:

(A) Things that are equal to the same are equal to each other.

(B) The two sides of this Triangle are things that are equal to the same.

(Z) The two sides of this Triangle are equal to each other.

T: Readers of Euclid will grant, I suppose, that Z follows logically from A and B, so that any one who accepts A and B as true, must accept Z as true?

A: Undoubtedly! The youngest child in High School—as soon as High Schools are invented, which will not be till some two thousand years later—will grant that.

T: And if some reader had not yet accepted A and B as true, he might still accept the sequence as a valid one, I suppose?

A: No doubt such a reader might exist. He might say, 'I accept as true the Hypothetical Proposition that, if A and B be true, Z must be true; but, I don't accept A and B as true.' Such a reader would do wisely in abandoning Euclid, and taking to football.

Inference and the Extension of Knowledge
What the Tortoise Said to Achilles II

T: And might there not also be some reader who would say, 'I accept A and B as true, but I don't accept the Hypothetical'?

A: Certainly there might. He, also, had better take to football.

T: "And neither of these readers," the Tortoise continued, "is as yet under any logical necessity to accept Z as true?"

A: "Quite so," Achilles assented.

T: Well, now, I want you to consider me as a reader of the second kind, and to force me, logically, to accept Z as true.

A: "A tortoise playing football would be", Achilles began

T: "—an anomaly, of course," the Tortoise hastily interrupted. "Don't wander from the point. Let's have Z first, and football afterwards!"

A: "I'm to force you to accept Z, am I?" Achilles said musingly. "And your present position is that you accept A and B, but you don't accept the Hypothetical—"

T: "Let's call it C," said the Tortoise.

Inference and the Extension of Knowledge
What the Tortoise Said to Achilles III

A: —but you don't accept

   (C) If A and B are true, Z must be true.

T: "That is my present position," said the Tortoise.

A: Then I must ask you to accept C.

T: "I'll do so," said the Tortoise, "as soon as you've entered it in that note-book of yours. What else have you got in it?"

A: "Only a few memoranda," said Achilles, nervously fluttering the leaves: "a few memoranda of—of the battles in which I have distinguished myself!"

T: "Plenty of blank leaves, I see!" the Tortoise cheerily remarked. "We shall need them all!" (Achilles shuddered.) "Now write as I dictate:—

(A) Things that are equal to the same are equal to each other.

(B) The two sides of this Triangle are things that are equal to the same.

(C) If A and B are true, Z must be true.

Inference and the Extension of Knowledge
What the Tortoise Said to Achilles IV

(Z) The two sides of this Triangle are equal to each other.

A: "You should call it D, not Z," said Achilles. "It comes next to the other three. If you accept A and B and C, you must accept Z."

T: And why must I?

A: Because it follows logically from them. If A and B and C are true, Z must be true. You don't dispute that, I imagine?

T: "If A and B and C are true, Z must be true," the Tortoise thoughtfully repeated. "That's another Hypothetical, isn't it? And, if I failed to see its truth, I might accept A and B and C, and still not accept Z, mightn't I?"

A: "You might," the candid hero admitted; "though such obtuseness would certainly be phenomenal. Still, the event is possible. So I must ask you to grant one more Hypothetical."

T: "Very good. I'm quite willing to grant it, as soon as you've written it down. We will call it

(D) If A and B and C are true, Z must be true. …

Inference and the Extension of Knowledge
Memorial preservation of inferential J & K

- Let's say you come to know or justifiedly believe *C*, by *inferring C* from *P* (and *K*), but you later *forget* your grounds (*P*) for believing *C*.

- Can you still know or justifiedly believe *C*?

- Yes. You can retain beliefs *as* knowledge or *as* justified beliefs, *even if* you don't retain your original grounds for the belief.

- You may find it difficult (or impossible) to say *how* you know in such cases (or even *whether* you know), but that doesn't imply that you fail to

- You may not even retain the belief *as inferential*, but memory can still preserve knowledge/just.

- If your memory of *C* is very weak, or if you get defeating evidence in the meantime, bets are off.