Epistemic Cognition

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Outline

- A. Clarifying the two key terms: epistemic & cognition

- B. Our current model: the AIR framework

- C. What is cognitive, what is metacognitive?

- D. Two prominent lines of research on epistemic cognition in psychology

- E. Six critiques of this research from learning sciences perspectives

A. CLARIFYING "EPISTEMIC" & "COGNITION"

Clarifying key terms.
1. Epistemic

■ Each of the statements on the next slide articulates an evaluation, description, or goal. Which of these evaluations/descriptions/goals is <u>epistemic</u>?

Which are epistemic?
(It is irrelevant whether the statement is correct.)

- 1. Knowledge is justified belief.
- 2. Julia is careful in her work as an accountant.
- 3. I want to get the highest score in the class.
- 4. A good way to learn is to use deep study strategies.
- 5. I enjoy a challenge.
- 6. The goal of history is to provide an interpretive narrative.
- 7. I want to understand this text.
- 8. To complete assignments as soon as possible, share the work with peers.
- 9. My group thinks that this model is a poor one because it doesn't have clear labels.
- 10. I know Angela Merkel has been the Chancellor of Germany since 2005 because I read it on Wikipedia.
- 11. The most trustworthy scientific studies have appropriate controls.
- 12. Recommendations for conducting historical inquiry are as follows: [List of recommendations]

1. What does "Epistemic" mean?

- Epistemic cognition / epistemic beliefs / personal epistemology / epistemic thinking.
- Epistemic: What is this? Common answers.
  - What knowledge is, what its sources are, and how it is justified.
  - Beliefs about knowledge and processes of knowing.
- Philosophers offer brief definitions like this, too.
- But… what do epistemologists actually study? Let's look at their practices, not just their brief definitions.

The scope of epistemic cognition

- **Epistemologists study a variety of cognitive and social phenomena. Here are some alternative ways of conceptualizing the field:**
- Alston (2005). Epistemologists investigate "the operation and condition of our cognitive faculties—perception, reasoning, belief formation, the products thereof—beliefs, arguments, theories, explanation, knowledge" (pp. 2-3).
- Goldman (1986). "Epistemology deals with … the whole range of efforts to know and understand the world, including the unrefined, workaday practices of the layman as well as the refined, specialized methods of the scientist or scholar. … The ways that minds do or should deal with [various topics that the mind can address], individually or in concert, comprise the province of epistemology" (p. 13).

The scope of epistemic cognition

- Kitcher (1994). "…social epistemology should be concerned with the organization of communities of knowers and with the processes that occur among knowers within such communities that promote both the collective and the individual acquisition of true belief" (p. 114).

- Haack (2001). "I take for granted the essentially evaluative character of epistemological concerns, the focus on what makes evidence better or worse, what determines to what degree a person is justified in a belief, how inquiry should be or is best conducted." (p. 22).

- Kvanvig (2003). "Epistemology would seem to have a large stake in inquiry regarding successful or valuable aspects of cognition, such as wisdom and understanding…." (p. 187).

The scope of epistemic cognition

- Kornblith (2001): Three central questions in epistemology: "(1) What is knowledge? (2) How is knowledge possible? (3) What should we do in order to attain knowledge?" (p. 159). This includes "investigating the various mechanisms by which knowledge is produced" and discovering "the strengths and weaknesses of our current cognitive condition" (p. 164).

- Sosa (2007): There are "…two parts of epistemology: (a) theory of knowledge, and (b) intellectual ethics. The latter concerns evaluation and norms pertinent to intellectual matters generally, with sensitivity to the full span of intellectual values."

- Zagzebski (1996): Argues that epistemology should be centered on the intellectual or epistemic virtues. "Knowledge is a state of belief arising out of acts of intellectual virtue." (p. 271).
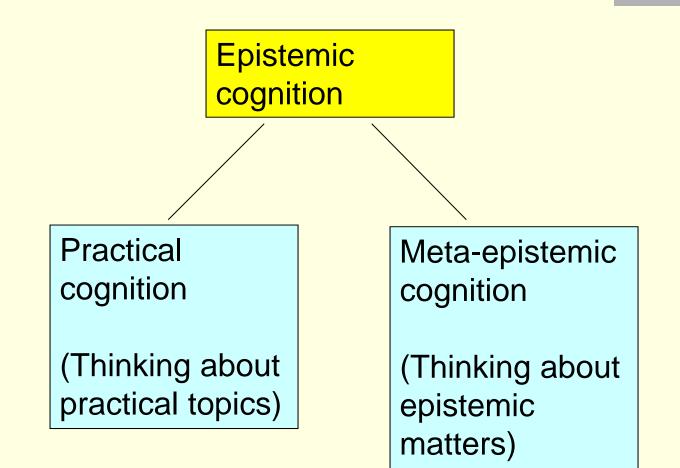
Epistemic aims: Is knowledge the only epistemic aim?

- Knowledge
- Wisdom
- Models
- Theories
- Explanations
- Understanding
- Justified beliefs
- True beliefs
- Avoiding false beliefs
- Conviction
- Proved beliefs

Epistemic aims: Is knowledge the only epistemic aim?

■ From Chinn, Rinehart, & Buckland (in press): Epistemic aims are not limited simply to *knowledge*. What all these aims (including knowledge, understanding, models, true beliefs, etc.) have in common is their representational nature, their providing a particular "take" on how things are, and thus their depiction of the world as one way and not another (K. Z. Elgin, personal communication, February 1, 2013).

■ Epistemic cognition, then, comprises networks of cognitions regarding epistemic aims, how to achieve them, and how to evaluate whether they have been achieved.

Cognition (our convention)

Epistemic cognition

Practical cognition

(Thinking about practical topics)

Meta-epistemic cognition

(Thinking about epistemic matters)

B. Our current model:
The AIR Framework

The AIR Framework

Chinn, C. A., Rinehart, R. W., & Buckland, L. A. (in press). Epistemic cognition and evaluating information: Applying the AIR model of epistemic cognition. In D. Rapp and J. Braasch (Eds.), *Processing inaccurate information*. Cambridge, MA: MIT Press.

- **A: Aims**

    A person's goals and the value she/he places on these goals.

- **I: Ideals**

    Ideals are the standards that a person uses to evaluate whether epistemic ends have been achieved.
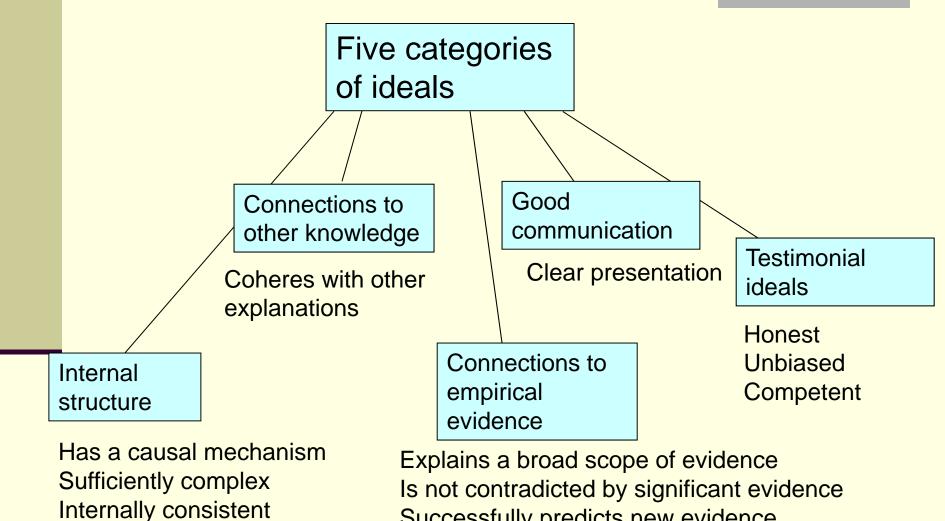
- **R: Reliable processes**

    Comprises causal schemas specifying the processes by which knowledge and other epistemic products are reliably produced.

    May also include associated procedural knowledge for executing these processes.

Ideals

- Term comes from Toulmin, who discussed scientists' "explanatory ideals" that guide the development.
- Ideals are criteria or standards used to evaluate epistemic products, or to set a "vision" for what you are aiming for when you create an epistemic product.
- What can be evaluated?
  - Theories
  - Explanations
  - Models
  - Inquiry methods
  - Institutional processes
  - Epistemic character of people (honesty, sincerity, etc.)
  - Etc.
- What are the criteria that scientists use to evaluate theories? Which of these would you predict that 13 year olds are aware of?

Some ideals

Five categories of ideals

Connections to other knowledge

Coheres with other explanations

Good communication

Clear presentation

Testimonial ideals

Honest
Unbiased
Competent

Internal structure

Has a causal mechanism
Sufficiently complex
Internally consistent

Connections to empirical evidence

Explains a broad scope of evidence
Is not contradicted by significant evidence
Successfully predicts new evidence

Reliable processes for achieving epistemic aims (such as knowledge)

- Includes:
  - Schemas specifying the reliable processes by which epistemic products (such as knowledge, understanding, explanations, or models) are produced.
  - Associated procedures for carrying out these reliable processes.
- Grounded in the philosophical work of Alvin Goldman.
- The core idea: There exist many different causal processes that can be used to try to produce true beliefs; these processes vary in reliability. A reliable process is one that produces a relatively high proportion of true beliefs. An unreliable process, by contrast, produces a relatively low proportion of true beliefs.
- Epistemic cognition consists in large measure of vast repertoire of such schemas that can be used to guide action and evaluation.
- Severely under-investigated

Examples of reliable processes
(from Chinn, Rinehart, & Buckland, in press)

Process	Active, procedural use	Evaluative use	Meta-epistemic reflection
Masked observation	Implement masked observation procedures when gathering data in a psychological study	When reading psychology journal article, check whether masked procedures are used; lower credence given to results if not.	Articulate one's schema and the conditions on it.
Evidence gathering processes	Seek out multiple perspectives on global warming when reaching a decision	Judge that a meta-analysis on rewards that examined only behaviorism-friendly journals is not trustworthy.	Articulate one's schema and the conditions on it.
Argumentation processes	When setting up a research group, include members with diverse backgrounds, and encourage full vetting of ideas.	Judge that a national commission evaluating a food additive that completed excluded one prominent perspective is not trustworthy.	Articulate one's schema and the conditions on it.

How schemas can be used (from Chinn, Rinehart, & Buckland, in press)

Process	Possible schema (may be incorrect)	Conditions
Observation & memory	Visual observation is highly accurate, and memory for observations is very good.	Accurate visual observation requires enough light and short-enough distances.
Evidence gathering processes	When gathering evidence on an issue, one should seek out evidence on multiple sides of a question.	This requires access to enough information and sufficient time to process it; reading a few studies is not enough.
Survey processes	Polling opinion with random samples of the population is a good way to determine what public opinion on an issue is.	Polls require very, very large samples in order to yield reliable results.
Argumentation processes	Argumentation is a good process for achieving good theories in science.	Effective argumentation requires cognitive diversity among members of the group and a willingness to seriously consider others' ideas.

C. Meta-epistemic thinking

Which are meta-epistemic?

- 1. Anecdotal evidence is not believable because lots of times, the people who give the anecdote have a misunderstanding of what is going on; they don't have all the facts.
- 2. Climate models are of questionable validity, in general, because there are so many variables entered that the permutations of changes multiply exponentially.
- 3. Knowledge in most domains is quite complex.
- 4. I disregard anecdotal evidence, period.
- 5. I don't think that global warming is occurring because this has been a very cold spring.
- 6. I think that the Atkins diet is ineffective because fat is bad for the heart.
- 7. I think that the Atkins diet is ineffective because it does not meet the essential criterion for theory choice of cohering with an established body of medical knowledge regarding the fat and health.
- 8. That's a good argument. You really explained the evidence very thoroughly by telling how they did the study.
- 9. Personal experiences are the best reasons to believe things because it's the only thing we can really be sure is true for us.
- 10. I am most likely to believe ideas if I can support them with my personal experiences.
- 11. This natural selection model is better than the other because it is supported by three pieces of good evidence, and contradicted by no good evidence. And the other model is supported by just one piece of evidence, but it is bad evidence.
- 12. This natural selection model is better than the other because it meets our criterion for good models--it fits all the good evidence and is not contradicted by other evidence.

Order of epistemic evaluation

Order	Focal topic of thinking	Mention & use of epistemic constructs	Examples
0 Enacted	A topic in a content domain (e.g., science topic)	Nothing explicit; implicit use	The energy model of mitochondria is better because we saw that joggers produce more energy and they have more mitochondria in their muscles.
0.5 Explicit reference during enacted EC	A topic in a content domain	Explicit mention in predicates, not subjects. Subject is content domain topic.	The energy model of mitochondria is better because that model meets most of our criteria for what makes a good model—especially fit with all the evidence.

Order of epistemic evaluation

Order	Focal topic of thinking	Mention & use of epistemic constructs	Examples
1 Epistemic reflection	Epistemic constructs	Explicit attributions to epistemic constructs	Good explanations meet the criterion of fitting all the evidence. I usually support knowledge claims with personal experience.
2 Epistemic justificat ion	Epistemic constructs and their evaluation	Explicit justification of attributions to epistemic constructs	Fitting the evidence is important because otherwise you could just make up ideas, and they might not be true. Personal experience is the best way to support knowledge claims because it is the only kind of evidence that you can totally trust. I think theories are complex because of these examples….. <list>

Order	Topic	Explicit use of Epistemic constructs	Type of use
0	Content topic	No	Implicit application
0/1	Content topic	Yes	Explicit application
1	Epistemic topic	Yes	Explicit attributions to epistemic constructs
2	Epistemic topic	Yes	Explicit justification of these attributions

D. Two prominent lines of research on epistemic cognition in psychology

Two very significant lines of research on epistemic cognition in psychology

- Developmental research, e.g., Deanna Kuhn.
  - Objectivism
  - Multiplism or relativism
  - Evaluativism
- Epistemic beliefs. Important framework developed by Hofer & Pintrich (1997):
  - Beliefs about knowledge
    - Its structure
    - How complex or simple it is
  - Beliefs about processes of knowing
    - Sources
    - Justification

Some sample items

- Students rate items such as these on a Likert scale:

  - 1. In [math/history], if you believe something is a fact, no one can prove to you that you are wrong. (Greene et al., 2011)
  - 2. Things written in [math/history] textbooks are true. (Greene et al., 2011)
  - 3. In [math/history], everyone's knowledge can be different because there is no one absolutely right answer. (Greene et al., 2011)
  - 4. My personal judgments about climate problems have little value compared to what I can learn about them from books and articles. (Bråten et al., 2008)
  - 5. When I read about issues concerning climate, the author's opinion is more important than mine. (Bråten et al., 2008)
  - 6. When I read about issues related to climate, I have most trust in claims that are based on scientific investigations. (Bråten et al., 2008)
  - 7. First-hand experience is the best way of knowing something in this field. (Hofer, 2000)
  - 8. There is really no way to determine whether someone has the right answer in this field. (Hofer, 2000)
  - 9. New scientific knowledge acquires its credibility through the recognition by many scientists in the field. (Tsai et al., 2005).
  - 10. Scientists' research activities will be affected by their existing theories. (Tsai et al., 2005).

■ What do you think about the items on the previous slide? What are their strengths and weaknesses?

Some sample items

- Kuhn, Cheney, & Weinstock (2000) (pp. 316-317).
  - Robin believes one book's explanation of how the brain works.
  - Chris believes another book's explanation of how the brain works.
  - Can only one of their views be right, or could both have some rightness? (circle one)
    - ONLY ONE RIGHT
    - BOTH COULD HAVE SOME RIGHTNESS
  - IF BOTH COULD BE RIGHT:
    - Could one view be better or more right than the other? (circle one)
      - ONE COULD BE MORE RIGHT
      - ONE COULD NOT BE MORE RIGHT THAN THE OTHER

Some sample items

- King & Kitchener's (1994) Reflective Judgment Interview. "There have been frequent reports about the relationship between chemicals that are added to foods and the safety of these foods. Some studies indicate that such chemicals can cause cancer, making these foods unsafe to eat. Other studies, however, show that chemical additives are not harmful, and actually make the foods containing them more safe to eat."

  - What do you think about these statements?
  - How did you come to that point of view?
  - Can you ever know for sure that your position on this issue is correct? How or why not?
  - When two people differ about matters such as this, is it the case that one opinion is right and one is wrong? If yes, what do you mean by "right"? If no, can you say that one opinion is in some way better than the other? What do you mean by "better"?
  - How is it possible that experts in the field disagree about this subject?

■ What do you think about the questions on the previous two slides? What are their strengths and weaknesses?

E. Critiques of psychological work from LS perspectives

Critique 1.
Scope of what is considered to be part of epistemic cognition. (We've already discussed this.)

LS bases of critique:
  1. Interdisciplinary approach
     (drawing on philosophy)
  2. Complexity of phenomena

Critique 2.
Beliefs / stances / etc. are less general and more situated than has often been assumed.

LS bases of critique:
1. Interdisciplinary approach (drawing on philosophy)
3. Situative approaches

"There have been frequent reports about the relationship between chemicals that are added to foods and the safety of these foods. Some studies indicate that such chemicals can cause cancer, making these foods unsafe to eat. Other studies, however, show that chemical additives are not harmful, and actually make the foods containing them more safe to eat." (King & Kitchener, 1994).

Suppose students give multiplist/relativist answers? What does this show?

Our position

- It shows, at most, that the respondent is a multiplist under a particular condition.

- Consider other problems that might be given, which express different conditions.

Consider:

- **LEAD.** Historically, many people believed that lead dishes were healthy to use. Now, all scientists and all governments agree that lead is harmful to human health, and that lead dishes should not be used for eating or drinking.

- **MERCURY.** A group of villagers on a Pacific island believes that, to be maximally healthy, people should eat as much Bluefin tuna as possible. However, the World Health Organization (and a list of other organizations) warn that Bluefin tunas have very high mercury content, that mercury is poisonous to the brain, and that consumption of large amounts of tuna is harmful to human health.
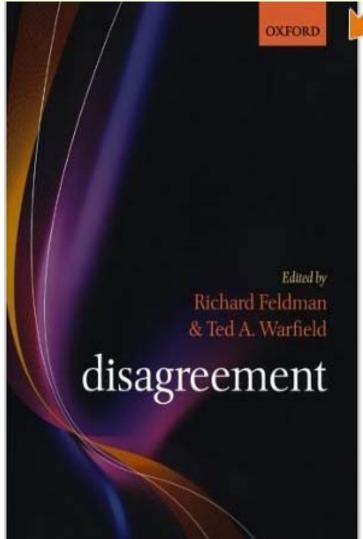
Consider:

- **Green dye.** The PR departments in some food producing corporations argue that Food Additive X, a green dye, is safe to consume. However, the American Medical Association, after reviewing 153 relevant studies, all of which show that X increases the risk of cancer, has concluded that X is associated with substantially higher risk of cancer.

Consider:

- **The tip.** Sue and Raj are at a restaurant. They agree to give exactly a 15% tip on their bill of $73.15. Sue computes the desired total as $84.12. Raj computes it as $85.12.

- **What is that black object?** Clark and Ron are looking out the window at an object lying on the quad outside, about 120 feet away. Clark believes that the object is a dead crow. Ron believes it is a baseball cap.

Some of the examples above are based on examples discussed in this book.

What is Relativism?

For psychologists, often: **a general epistemic stance**.

For philosophers: "relative" is a 3-place-predicate:

X is relative to Y under conditions Z. *

Examples of X and Y:

- *Ethical truths* are relative to *culture*.
- *Ethical truths* are relative to *the individual*.
- *Good methods of inquiry* are relative to *the individual*.

Examples of Z:

- *Truth is relative to theory when **experts are evenly divided**.*
- *Truth is **not** relative to theory **when I have evidence to consider**.*

Examples of X (What is relative?)
Examples of Y (Relative to what?)

X: What is relative?

- Central concepts
- Beliefs
- Perception
- Epistemic appraisal
- Ethics
- Aesthetics
- Etiquette
- Truth
- Falsity
- Reality

Y: Relative to what?

- Language
- Culture
- Historical era
- Cognitive Architecture
- Scientific framework
- Assumptions
- Religion
- Gender, race, social status
- The individual

Z: The conditions

- Existing problems have tended to employ scenarios that meet this condition:
  - Sparse scenarios, with sparsely specified alternative theories; proponents on each side are epistemic peers with implied equal evidence, none of it available for inspection
- It is questionable whether these conditions frequently hold in authentic situations.
- They certainly fail to hold in many, many everyday situations.

An alternative approach

- Instead of trying to identify stances, identify the strategies people use to resolve disagreements and the conditions under which different strategies are used.

- Development involves shifts in the repertoire of strategies, their relative frequency, and the conditions under which they are used.

Critique 3.

Asking how much *fairly general beliefs* matter.

LS bases of critique:
1. Interdisciplinary approach
   (drawing on philosophy)
3. Situative approaches
4. Specific domain knowledge matters a lot

How much do relatively general beliefs matter? (A few brief remarks.)

■ Given that many beliefs are situated, how do people even go about answering general question, or responding to general Likert scale items? And what do their responses mean?

■ Low correlations between relatively general measures and performances.

■ Riesch (2010): Many scientists espouse Popperianism--the philosophy that science operates by falsification of theories, never actually verifying any theory. But scientists certainly do not behave in this way. There are many responses to anomalous data besides falsifying one's theory, and verification-leaning approaches seem alive and well in scientific journals.

Critique 4.
Querying epistemic cognition as beliefs along continua.
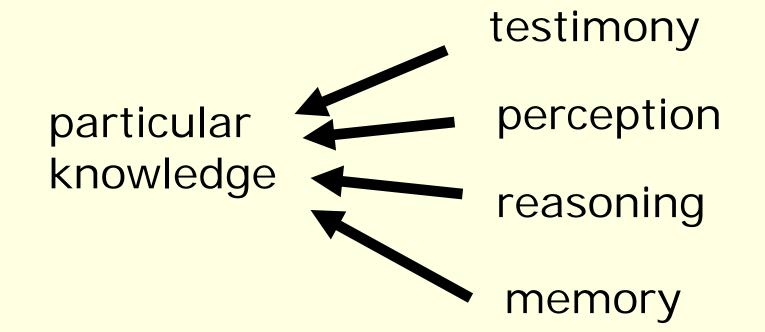
LS bases of critique:
      2. Complexity of phenomena

The example of sources
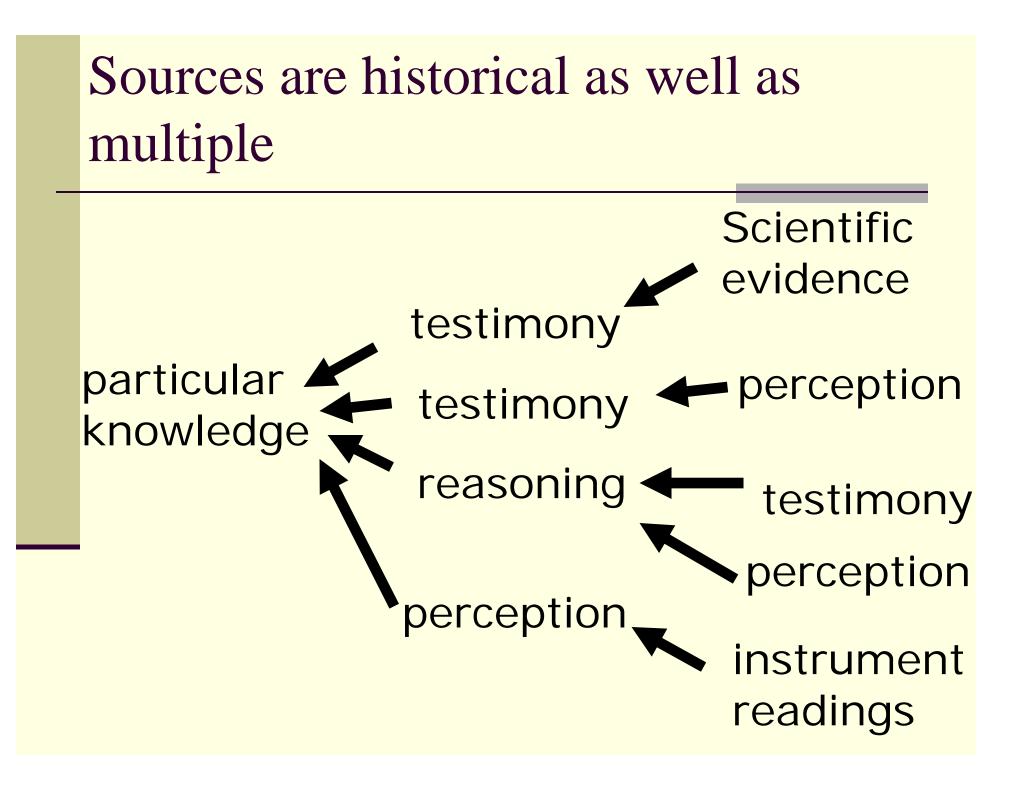
Much research to date:

experience ⟷ authority

But sources are almost always multiple:

testimony

perception

particular
knowledge

reasoning

memory

Sources are always multiple….

- In addition:
  - Testimony is almost always involved.
  - Memory is almost always involved.

Sources are historical as well as multiple

Scientific evidence

testimony

particular knowledge

testimony ← perception

reasoning ← testimony

perception

perception

instrument readings

Sources are historical as well as multiple

- In other words, sources can be viewed as complex causal processes that produce knowledge.

Critique 5.

Moving toward a finer-grained analyses

LS bases of critique:

     2. Complexity of phenomena

     3. Situative approaches

Finer grained perspectives

- Using "rules of inquiry" as a criterion
  - …experiments, replication, peer review.
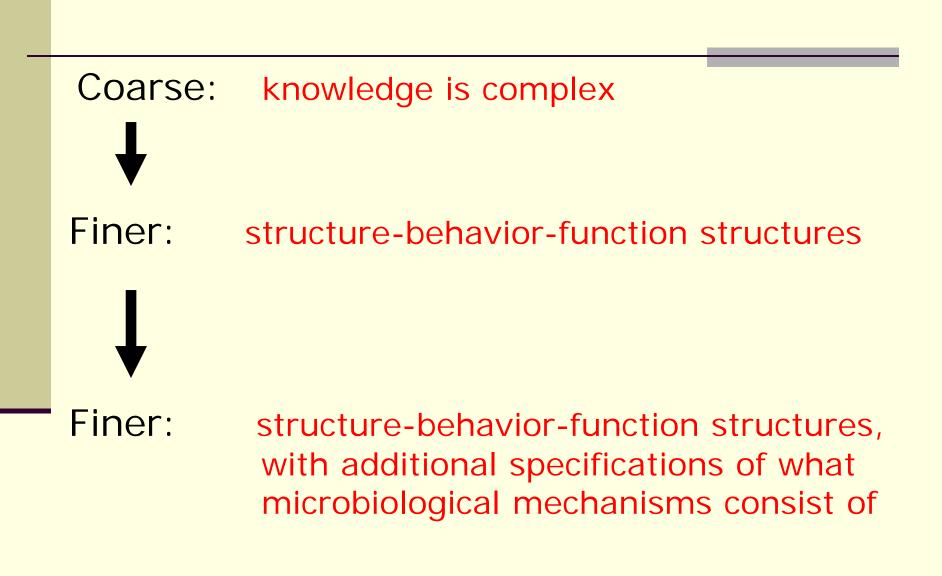 - …narratives of lived experience.
- Using "congruence with personal experience" as a criterion…
  - …my gut feelings.
  - …I carefully record how my body reacts to different foods
- Using "fit with good evidence" as a criterion…
  - …fit with all the scientific evidence.
  - …my own and others' experiences.

■ To understand how people think and reason, we'll need access to the more fine-grained criteria, not the more coarse-grained criteria.

Coarse: experience, rules of inquiry, evidence

↓

Finer: specific evidentiary standards (fit with all evidence, fit with all the good evidence?), simplicity, coherence with other theories

↓

Finer: (what counts as good evidence in this context versus that context)

Coarse: knowledge is complex

↓

Finer: structure-behavior-function structures

↓

Finer: structure-behavior-function structures, with additional specifications of what microbiological mechanisms consist of

Critique 6.

Greater focus on social epistemology including testimony

LS bases of critique:

5. Individual cognitive life embedded in the social

Testimony, not authority, as a source / justification

- Philosophers: testimony is ubiquitous as a source of knowledge
- Must rely on expert testimony outside our domains of expertise.
- But it goes much further. Experts' knowledge of own areas of expertise is mainly through testimony.
- Experts' knowledge of their own <u>empirical</u> research is thoroughly grounded in testimony.
- Ultimately, the concepts experts and non-experts use are grounded in the testimony of their language communities.
- Testimony is a more productive construct than "authority" and is more compatible with socio-trends in education.

Social Processes and Units of Analysis

- Achieving our epistemic aims is fundamentally and irreducibly social

- To this point research has overwhelmingly focused on the individual.

Summary of critiques from an LS perspective

- Expanded scope
- Situated approaches
- Questioning the extent to which general beliefs matter.
- Questioning epistemic cognition as beliefs along continua
- Moving toward finer-grained analyses
- Testimony not authority

- Based on
  - Interdisciplinary approach
  - Complexity of phenomena
  - Situative approaches
  - Specific domain knowledge matters
  - Individual cognitive life embedded in the social