HEB 1300: Evolutionary Origins of the Human Mind
Spring 2017 meeting time: M-W 1-2:30
MCZ 529 (26 Oxford St Entrance, 5th floor)

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Course Description
Human behavior is strikingly different from other animals: we speak languages, create tools, work together on large-scale endeavors, and even learn from others in university classrooms. What cognitive processes underlie these behaviors, and how did they emerge in our evolutionary history? In this course, we will examine the evolutionary origins of human cognition, with an eye to identifying what human psychological capacities are unique versus shared with other species. To do so, we will integrate current theoretical perspectives from biology concerning the evolution of intelligent behavior, with cutting-edge empirical research from comparative psychology that directly tests these ideas. Topics will include: cooperation, communication, theory of mind, culture, morality, emotions, memory, foresight, and self-control. We will focus on humans and other primates, but also examine instances of convergence in species including birds, canines, and cetaceans.

Enrollment
This course is intended primarily for undergraduates. The prerequisites are at least one of the following courses, indicating some familiarity with psychology and/or evolutionary theories of behavior: HEB 1280; HEB 1329; HEB 1330; Science of Living Systems 15; Science of Living Systems 20; or permission from instructor.

Course Objectives
This course will integrate evolutionary theory and experimental comparative psychology to understand the evolutionary history of human cognition. There is no assigned textbook; readings will consist of primary literature and reviews. This course will briefly cover basic evolutionary theory and basic psychological methods as they pertain to course material, but students will be expected to have some familiarity with psychology and/or primate behavior.

Grade
Your course grade will be determined by:
- Your participation in three class discussions (10%)
- Quizzes (10%)
- Three response papers (10% each)
- A midterm (20%)
- A cumulative final (30%)

Lectures: Students are expected to attend lecture. The powerpoint slides will be posted online after the lecture.

Discussion sessions: Three class sessions (dates indicated below) will involve in-class discussion, and your participation in those discussions will comprise your participation grade. For each session, we will discuss the assigned papers in class so you should have *read those papers prior to class.*

- *Missed discussion sections:* If you miss a discussion session your participation grade will be docked by 1/3.
- *Make-up response paper:* If you have a **documented** reason for missing the discussion session (letter from doctor or dean documenting illness or emergency; letter from another professor, advisor, or coach documenting completely unavoidable conflict), then you will be allowed to make up this part of your participation grade by writing an *additional response paper* about the three readings discussed in that session. **This response paper will be due no later than 1 week after the discussion session**, except in cases of *documented* illness or emergency that preclude completion of the work in that timeframe.

Response papers: Understanding how to critically read empirical research and synthesize theoretical ideas are critical jobs both for scientists and the public at large. You will complete three response papers that summarize a paper(s)' argument, and then either argue your point of view, critique their interpretation of their data, or sketch a proposal for a new experiment building on their work.

- *Deadline:* Your response paper must be uploaded to the Canvas website (under that assignment) by Sunday at 8pm on the week it is due. Response papers will be graded on a 10-point scale. **Every day your paper is late will reduce your score by 10%, starting at 8.01PM that day without exceptions.**
- *Format:* At least 2 but no more than 21/2 pages, single spaced, 1 inch margins, 12pt Times New Roman font. **Your grade will be dropped by 10% for not following this format.** Please include your name, date, and the response paper number in the document header. Name your files:
  [*Lastname_Firstname*]_Response_[*papernumber*]
  e.g., "Harvard_Joan_Response_3.doc"

Quizzes: Some lectures will commence with an initial quiz, focusing on material covered the previous week (dates noted below). This quiz will serve as a check-in for yourself as well as a way for us to gauge class-wide comprehension of critical concepts.

- *Grading:* Quizzes will be graded with check if you complete the quiz (regardless of response accuracy), and a minus if you are absent (or do not make a good-faith effort to complete the quiz, for example by answering some questions or filling out the quiz with a meaningless non-intelligible response).
- *Final score:* If you complete at least 7 of 9 quizzes with a check, then you will get *full credit* on the quiz portion of your grade. As such, there will be *no make-up quizzes offered.* Failing to complete each additional quiz below the requisite 7 will reduce your total quiz score by 10% (e.g., completing 6 quizzes results in a score of 90% for that portion of your grade).

Midterm & Final Exam: The midterm will be in class, and there will be a final exam during exam period (date: May 5, 2017).

- *Exam format:* Exams will be composed of a mixture of multiple choice, true/false, fill in the blank, and matching questions, as well as short (paragraph-length) essays. *Accommodations:* Students with disabilities will always be accommodated. Please consult the instructor at least one week before an exam to explain your requirements for ADA accommodations (e.g. different room, longer exam period).
- *Missed exams:* Make-up exams will not be allowed except in the case of documented medical or familial emergencies.

Academic Integrity: Discussion and the exchange of ideas are essential to academic work. For response paper assignments in this course, you are encouraged to consult with your classmates on the choice of paper topics and to share resources. However, you should ensure that *any written work you submit for evaluation is your own*--the result of your own research, ideas, and writing. You must also adhere to standard citation practices and properly cite any books, articles, websites, lectures, etc. that have helped you with your work. Work on midterms and finals should be yours alone.

COURSE TOPICS

Week 1: Human uniqueness I

1. Jan 23: The puzzle of human cognition

Darwin famously said, “the difference in mind between man and the higher animals, great as it is, certainly is one of degree and not of kind.” Biologists, psychologists, and philosophers since have debated the degree of continuity or discontinuity between human and animal minds. What is (potentially) distinct about human minds? How can we test these proposals scientifically?

Introduction to course and objectives. No readings.

2. Jan 25: What’s so special about humans?

What’s different about human behavior compared to other species? What’s shared? This lecture will cover behavioral differences between humans and our close relatives, focusing on great apes and traditional human societies such as hunter-gatherers.

Readings:

- McGrew (2010). In search of the last common ancestor: new findings on wild chimpanzees. *Philosophical Transactions of the Royal Society B.*
- Hill et al. (2009) The emergence of human uniqueness: Characters underlying behavioral modernity. *Evolutionary Anthropology*
- Kaplan et al. (2000) A theory of human life history evolution: Diet, intelligence, and longevity. *Evolutionary Anthropology.*

Week 2: Theory I

3. Jan 30: What is cognition?

How is behavior implemented in the mind and brain? This lecture will cover some basic ideas we will use in the rest of the course: the difference between observable behavior and underlying mental states (and how experimental methods can parse those mental states), theories about how the mind is structured (empiricism, nativism, domain specificity, and modularity), and levels of analysis for understanding behavior (mechanism versus evolution).

Readings:

- Pylyshyn (1999). What's in your mind? In: *What is Cognitive Science.*
- Tomasello & Call (1997) *Primate Cognition*. Chapter 1 – Introduction.
- Shettleworth (2010). *Cognition, Evolution, and Behavior.* Chapter 1 – Cognition and the study of behavior.

4. Feb 1: What is evolution?

How do traits (such as cognition) evolve? This lecture will cover basic concepts relevant for understanding the evolution of cognition, including: phenotype and genotype, natural selection, adaptations, and phylogeny (patterns of relatedness between populations).

Readings:

- Endler (1986) *Natural Selection in the Wild*: Chapter 1: Introduction
- Bateson & Laland (2013) Tinbergen's four questions: an appreciation and an update. *Trends in Ecology and Evolution.*
- Laland & Brown (2002). *Sense and nonsense.* Chapter 2: "A history of evolution and human behavior"; Chapter 8: "Comparing and integrating approaches."

Week 3: Theory II

5. Feb 6: Why does cognition evolve?

Are there different ways to be smart? And what are the potential benefits? This lecture will cover theories for why organisms (such as humans) might evolve intelligent or flexible behavior, including: the social intelligence hypothesis, the ecological intelligence hypothesis, and the cultural intelligence hypothesis.

Readings:

- Dunbar & Shultz (2007) Evolution in the social brain. *Science.*
- Sherry (2006) Neuroecology. *Annual Review of Psychology*.
- Herrmann et al (2007). Humans have evolved specialized skills of social cognition: The cultural intelligence hypothesis. *Science.*

QUIZ 1: Natural selection

6. Feb 8: How is cognitive evolution measured?

We cannot see cognition directly, and it leaves no trace in the fossil record. So how can we tell if cognition has evolved across time and populations? This lecture will cover the techniques used to detect cognitive evolution, including: the comparative method, differences in fitness, genetic signatures of selection, and brain evolution.

Readings:

- Shettleworth (2010). *Cognition, Evolution, and Behavior.* Chapter 2 – Evolution, behavior, and cognition: A primer.
- Silk et al (2007). Social components of fitness in primate groups. *Science.*
- MacLean et al. (2012). How does cognition evolve? Phylogenetic comparative psychology. *Animal Cognition.*

Week 4: Social cognition I

7. Feb 13: Theory of mind

Humans can think not only about other's observable behavior, but also about unobservable mental states that drive that behavior: other people's thoughts, desires, and goals. Can other animals do the same? How might differences in "theory of mind" change human behavior compared to other species?

Readings:

- Apperley (2011). *Mindreaders*. Chapter 1 – Introduction; Chapter 3 - Evidence from Infants and Animals
- Call & Tomasello. (2008). Does the chimpanzee have a theory of mind? 30 years later. *Trends in Cognitive Sciences.*
- Krupenye et al (2016) Great apes anticipate that other individuals will act according to false beliefs. *Science*.

QUIZ 2: Comparative method

8. February 15: Language and communication

One of the most striking differences between humans and nonhumans is our language abilities. What are the core features of human language, and how do they differ from nonhuman communicative capacities? Does human language have its roots in vocal communication or gesture? Can other animals remark about the world?

Readings:

- Corballis (2009). The evolution of language. *Annals of NY Academy of Sciences.*
- Schlenker et al (2016) What do monkey calls mean? *Trends in Cognitive Sciences.*
- Slocombe & Zuberbühler (2005). Functionally referential communication in a chimpanzee. *Current Biology.*

Reminder about response paper due Sunday Feb. 26.

Week 4: Social cognition II

Feb 20: ****HOLIDAY NO CLASS****

9. Feb. 22 Mutualism and reciprocity

Human society is marked by high degrees of cooperation between individuals to reach larger goals. What skills do other species use to work together? How do these skills shape the organization of primate social life?

Readings:

- Engelmann et al (2015). Chimpanzees trust conspecific to engage in low-cost reciprocity. *Proceedings of the Royal Society B.*
- Melis et al (2016). One for me, one for you: Human's unique turn-taking skills. *Psychological Science.*
- Tomasello et al (2012). Two key steps in the evolution of human cooperation. *Current Anthropology.*

QUIZ 3: Theory of mind

Response paper 1: Theories of cognitive evolution. DUE SUNDAY FEB 26.

(1) Compare and contrast the three major theories for the evolution of intelligence: social, ecological, and cultural (Feb 6 lecture and readings).
(2) Argue which one (or more) of these theories is most compelling to you as an explanation for cognitive abilities across primates in general.
(3) Address whether you think different explanations might account for cognitive evolution in humans, versus whether the processes leading to human intelligence are extensions of those shaping nonhuman primate minds.

Week 6: Social cognition III

10. Feb 27: ***CLASS DISCUSSION***—Altruism

Tennyson famously said that nature was "red in tooth and claw." Yet humans see to care about giving others a helping hand and being fair. Do other species exhibit such responses, and what does it mean if they do? Complete readings *before* class!

Readings:

- Silk et al (2005). Chimpanzees are indifferent to the welfare of unrelated group members. *Nature*.
- Warneken et al (2007) Spontaneous altruism by chimpanzees and young children. *PLoS Biology*.
- Bullinger et al. (2014) Chimpanzees instrumentally help but do not communicate in a mutualistic cooperative task. *Journal of Comparative Psychology.*

Questions about midterm in class.

11. March 1: Culture and teaching

When Jane Goodall first discovered that chimpanzees make tools, Louis Leakey famously wrote that "we must redefine 'tool', redefine 'man', or accept chimpanzees as humans." Yet our abilities to copy and learn from other's behavior—such as to create material culture—seem to far exceed other species. How cultural are other species? And how do they learn such behaviors?

Readings:

- van Schaik (2016). *The Primate Origins of Human Nature.* Chapter 9 – The evolution of technology.
- Gruber et al (2009). Wild chimpanzees rely on cultural knowledge to solve an experimental honey acquisition task. *Current Biology.*
- Csibra & Gergely (2011). Natural pedagogy as an evolutionary adaptation. *Philosophical Transactions of the Royal Society B.*

QUIZ 4: Cooperation

Week 7: Ecological cognition I (and MIDTERM)

Mar 6: ****MIDTERM**** (Topics through week 6)

12. Mar 8: Memory and Planning

Some have proposed that animals are "stuck in time" because they cannot imagine past or future events like humans do. How do animals think about previous episodes or plan for the future? Can animals engage in "mental time travel?" Does it matter if we cannot know for sure if their experience is like ours?

Readings:

- Clayton et al. (2003) Can animals recall the past and plan for the future? *Nature Reviews Neuroscience.*
- Osvath & Martin-Ordas (2014). The future of future-oriented cognition in nonhumans: theory and the empirical case of the great apes. *Philosophical transactions of the Royal Society B.*
- Kano & Hirata (2015). Great apes make anticipatory looks based on long-term memory of single events. *Current Biology.*

Mar 13: ****SPRING BREAK NO CLASS****

Mar 15: ****SPRING BREAK NO CLASS****

Week 8: Ecological cognition II

13. Mar 20: Decision-making and economics

The last few decades of research in psychological and behavioral economics indicates that humans can be quite irrational when making decisions. Or rather: we are irrational from the perspective of traditional economic theory. Do other species show similar biases? What can this tell us about defining rationality in humans?

Readings:

- Santos & Rosati (2015). The evolutionary roots of human decision-making. *Annual Review of Psychology*.
- Lakshminaryanan, Chen, & Santos (2011). The evolution of decision-making under risk: Framing effects in monkey risk preferences. *Journal of Experimental Social Psychology.*
- Brosnan et al. (2007). Endowment effects in chimpanzees. *Current Biology.*

QUIZ 5: Memory

14. Mar 22: ***CLASS DISCUSSION***—Self-control

Problems of self-control can plague humans—how soon after New Year's did you violate your resolution?—but some have suggested that animals have an even more difficult time. What is the evidence that animals can inhibit undesirable responses, and flexibly update their behavioral responses? Do humans have special abilities to exert control over their actions? Complete readings *before* class!

Readings:

- Stevens (2014). Evolutionary pressures on primate intertemporal choice. *Proceedings of the Royal Society B.*
- MacLean et al (2014). The evolution of self-control. *PNAS.*
- Herrmann et al (2014) Uniquely human self-control begins at school age. *Developmental Science*.

In class: response paper 2 instructions and overview of QALMRI method. Reference document for QALMRI: Kosslyn & Rosenberg (2001). Psychology: The Brain, The Person, The World.

Week 9: Beyond cognition

15. Mar 27: Metacognition and self-awareness

Metacognition encompasses a set of cognitive processes allowing individuals to think about thinking. While humans can contemplate their own mental states across a variety of domains, it is currently debated whether such representational abilities are a human-specific ability or more widely shared. This session will examine the evidence for and against human-animal continuity in metacognition and self-awareness more broadly.

Readings:

- Smith (2009) The study of animal metacognition. *Trends in Cognitive Sciences.*

- Rosati & Santos (2016). Spontaneous metacognition in rhesus monkeys. *Psychological Science*.
- Suddendorf & Butler (2013). The nature of visual self-recognition. *Trends in Cognitive Sciences.*

16. Mar 29: Emotions

Darwin noted that "the fact that the lower animals are excited by the same emotions as ourselves is so well established, that it will not be necessary to weary the reader by many details." Yet those details have been debated ever since. So what are the details? Do nonhumans have emotional experiences like humans, at least in part?

Readings:

- Parr et al (2005). Emotional communication in primates: implications for neurobiology. *Current Opinion in Neurobiology.*
- Panksepp & Panksepp (2013). Toward a cross-species understanding of empathy. *Trends in Neurosciences.*
- Davila Ross et al (2009). Reconstructing the evolution of laugher in great apes and humans. *Current Biology.*

QUIZ 6: Decision-making

Response paper 2: Primate cognition. DUE SUNDAY APRIL 2.

Pick one of the following: Cooperation - Melis et al (2016); Memory and mental time travel - Kano & Hirata (2015); Decision-making - Brosnan et al (2007).

(1) Use the QUALMRI method to examine the paper. Describe the broader theoretical question they are trying to address (see lecture goals from that session for clues if needed).

(2) Propose a new experimental condition or test of their idea. What does data from this *primate* species tell you about the evolution of the human mind?

Week 10: Cognitive development

17. Apr 3: Human cognitive development

Human cognition does not emerge from the womb fully formed: the mind and behavior of an infant is not identical to that of an adult. How do different cognitive abilities develop over human ontogeny? What is the basis of cognitive change within an individual's lifespan?

Readings:

- Wellman & Gelman (1992) Foundational theories of core domains. *Annual Review of Psychology.*
- Flavell (1999) Children's knowledge about the mind. *Annual Review of Psychology.*
- Spelke & Kinzler (2007). Core knowledge. *Developmental Science.*

18. Apr 5: Life history and comparative development
How do human developmental patterns differ from that of other primates? What role does development play in shaping variation in cognition across species generally? Does development play a special role in the emergence of uniquely-human cognition?

Readings:
- Gould (1980) "A biological homage to Mickey Mouse." Chapter 9 from *The Panda's Thumb.*
- Kramer & Ellison (2010). Pooled energy budgets: Resituating human energy allocation trade-offs. *Evolutionary Anthropology.*
- Rosati et al. (2014). Comparative developmental psychology: How is human cognitive development unique? *Evolutionary Psychology*

QUIZ 7: Metacognition

Week 11: Convergent evolution I
19. April 10: Domestication
Humans have shaped the bodies and behavior many different animals. This session will examine how artificial selection shapes cognition across species, with a special focus on how changes in development are a mechanism for generating evolutionary change.

Readings:
- Trut (1999). Early canid domestication: The farm-fox experiment. *American Scientist.*
- Hare et al (2005). Social cognitive evolution in captive foxes in a correlated by-product of experimental domestication. *Current Biology.*
- Hare et al (2012). The self-domestication hypothesis: evolution of bonobo psychology is due to selection against aggression. *Animal Behaviour.*

QUIZ 8: Life history

20. April 12: ***CLASS DISCUSSION***—Dogs and wolves
Dogs and humans have lived together for thousands of years, and most people with a pet dog have an anecdote about a time their dog did something suspiciously human. But was it? This session will examine the hypothesis that dogs have evolved special cognitive skills for living with humans, though comparisons of dogs and wolves.
Complete readings *before* class!

Readings:
- Topal et al (2009). Differential sensitivity to human communication in dogs, wolves, and human infants. *Science.*
- Udell (2015). When dogs look back: inhibition of independent problem-solving behavior in domestic dogs compared with wolves. *Proceedings of the Royal Society B.*

- Johnston et al (2016). Exploring the evolutionary origins of overimitation: a comparison across domesticated and non-domesticated canids. *Developmental Science.*

Week 12: Convergent evolution II

21. April 17: Birds and reptiles

Is being accused of having a birdbrain actually an insult? This lecture will cover recent evidence for sophisticated behavior and cognition and birds, and make the case that some bird species can be considered a "feathered ape." We will also look at whether some mammalian and avian skills have deep roots in reptile cognition.

Readings:

- Emery & Clayton (2004) The mentality crows: convergent evolution of intelligence in corvids and apes. *Science*
- Bugnyar & Heinrich (2005). Ravens differentiate between knowledgeable and ignorant competitors. *Proceedings of the Royal Society B.*
- Wilkinson et al (2010). Gaze following in the red-footed tortoise (*Geochelone carbonaria*). *Animal Cognition.*

Reminder about response paper due Sunday April 24.

22. April 19: Mammal grab bag

Lots of big-brained mammals such as elephants and dolphins are colloquially considered smart, e.g. "an elephant never forgets." Is that actually true? What about instances of intelligence in other taxa, such as hyenas? Is there some commonality governing which species show complex cognition?

Readings:

- Plotnik et al (2011). Elephants know when they need a helping trunk in a cooperative task. *Proceedings of the National Academy of Sciences.*
- Holekamp et al (2007). Social intelligence in the spotted hyena (*Crocuta crocuta*). *Proceedings of the Royal Society B.*
- Brent et al (2015). Ecological knowledge, leadership, and the evolution of menopause in killer whales. *Current Biology.*

QUIZ 9: Domestication

RESPONSE PAPER 3: Cognitive Convergence. DUE SUNDAY APRIL 23.

Pick one of the following species: foxes—Hare et al (2005); ravens—Bugnyar & Heinrich (2005), or elephants—Plotnik et al (2011).

(1) Use the QUALMRI method to examine the paper. Describe the broader theoretical question they are trying to address (see lecture goals from that session for clues if needed).

(2) Propose a new experimental condition or test of their idea. What does data from this *primate* species tell you about the evolution of the human mind?

Week 13: Human Uniqueness II

23. April 24: Reconstructing hominin minds

Scientists already debate whether we can ever really know what another species is thinking or experiencing. This problem is even more difficult when thinking about extinct species like our hominin ancestors. How can we reconstruct the mind of these creatures in order to understand human uniqueness? This session will integrate approaches from neurobiology, genetics, fossils, and the archeological record with the comparative cognitive data we have examined the rest of the semester.

Readings:

- Schoenemann (2006) Evolution of the size and functional areas of the human brain*. Annual Review of Anthropology.*
- Somel et al (2013). Human brain evolution: transcripts, metabolites and the regulators. *Nature Reviews Neuroscience*.
- Nowell (2010). Defining behavioral modernity in the context of Neanderthal and anatomically modern human populations. *Annual Review of Anthropology.*

24. April 26: Wrap up: Why we need animals to understand human cognition

No readings.