

Psychology 330-02
Human Cognitive Evolution
Spring 2018
M-W 1-2:30 (1372 East Hall)

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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 the human mind by integrating theoretical perspectives from biology with cutting-edge empirical research from psychology. Topics will include the origins of human cooperation, communication, theory of mind, culture, morality, emotions, memory, foresight, and self-control. This course consists primarily of lectures, with three in-class discussion seminars on topics of current debate. Readings will consist of a mixture of empirical articles and review chapters; all readings be posted electronically. Performance will be assessed through participation in discussion seminars and in-class quizzes; response papers analyzing empirical research; and a midterm and final exam.

Course Objectives

This course will integrate evolutionary theory and experimental comparative psychology to understand the evolutionary history of human cognition. The focus will be on establishing a strong foundational knowledge in the evolution of cognition, including reading and critically analyzing empirical scientific studies.

Pre-requisites

Pre-requisites for this course are at least one of the following courses, indicating some familiarity with psychology: Psych 230 (Intro Behavioral Neuroscience), Psych 240 (Intro to Cognitive Psychology) or Psych 250 (Intro to Developmental Psychology).

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 LSA advisor 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 Monday at 9AM 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 9:01AM that day without exceptions.**
- *Format:* At least 2 but no more than 2 1/2 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., "Smith_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 8 of 10 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 8 will reduce your total quiz score by 10% (e.g., completing 7 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 (Tuesday April 24 from 4-6PM).

- *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 Prof. Rosati 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 AND READINGS BY WEEK

Week 1: Human uniqueness I

1. January 3: 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.

Week 2: Theory I

2. January 8: 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*.

3. January 10: 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.

Week 3: Theory II

January 15: ****MLK HOLIDAY NO CLASS****

4. January 17: 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 4: Theory III

5. January 22: 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*.
- Rosati (2017) Foraging cognition: reviving the ecological intelligence hypothesis. *Trends in Cognitive Sciences*.
- Herrmann et al (2007). Humans have evolved specialized skills of social cognition: The cultural intelligence hypothesis. *Science*.

QUIZ 1: Natural selection

6. January 24: 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. January 29: 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.
- Krupenye et al (2016) Great apes anticipate that other individuals will act according to false beliefs. *Science*.
- Bray et al (2014). Ring-tailed lemurs (*Lemur catta*) exploit information about what others can see but not what they can hear. *Animal Cognition*.

QUIZ 2: Comparative method

8. January 31: 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*.
- Bullinger et al (2011). Different social motives in the gestural communication of chimpanzees and human children. *Developmental Science*.

Week 5: Social cognition II

9. February 5: **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*.

In class: response paper instructions for paper due Feb 12, and overview of QALMRI method. Reference document for QALMRI: Kosslyn & Rosenberg (2001). Psychology: The Brain, The Person, The World.

10. February 7 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:

- Tomasello et al (2012). Two key steps in the evolution of human cooperation. *Current Anthropology*.
- 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*.

QUIZ 3: Theory of mind

Week 6: Social cognition III

Response paper 1: Primate social cognition. DUE MONDAY FEBRUARY 12.

Pick one of the following: Theory of Mind – Bray et al (2014); Communication: Bullinger et al (2011); Cooperation – Engelmann et al (2015)

- (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?

11. February 12: 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 laughter in great apes and humans. *Current Biology*.

QUIZ 4: Cooperation **CRLT visit**

12. February 14: 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*.

Questions about midterm in class.

Week 7: MIDTERM and Ecological cognition I

February 19: ****MIDTERM**** (Topics through week 6)

13. February 21: 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*.
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February 26: ****SPRING BREAK NO CLASS****

February 28: ****SPRING BREAK NO CLASS****

Week 8: Ecological cognition II

14. March 5: Rationality and decision-making

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

15. March 7: Guest lecture: Capuchin decision-making (Dr. Francesca de Petrillo)

Capuchins are a well-studied comparative system for the evolution of cognition in general and decision-making in particular. Dr. Francesca de Petrillo will speak about her work examining how capuchins make decisions about risk and time.

Readings:

- Fragaszy et al (2004). *The Complete Capuchin*. “Behavioral ecology: how do capuchins make a living?”
 - Addessi et al (2011). The ecological rationality of delay tolerance: insights from capuchin monkeys. *Cognition*.
 - de Petrillo et al (2015). Do tufted capuchin monkeys play the odds? Flexible risk preferences in *Sapajus* spp. *Animal Cognition*.
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Week 9: Ecological cognition III

16. March 12: **CLASS DISCUSSION**—Self-control

Problems of self-control, such as dieting, saving money, or preparing for the future, are a challenge for people. How do animals fare? Do humans have special abilities to exert self-control? **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*.

Reminder about response paper due March 19.

17. March 14: 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 debated whether such representational abilities are a human-specific ability or more widely shared.

Readings:

- Smith (2009) The study of animal metacognition. *Trends in Cognitive Sciences*.
- Ferrigno et al (2017) A metacognitive illusion in monkeys. *Proceedings B*.
- Bohn et al (2017) Information seeking about tool properties in great apes. *Scientific Reports*.

QUIZ 6: Decision-making

Week 10: Cognitive Development

Response paper 2: Primate ecological cognition. DUE MARCH 19.

Pick one of the following: Memory and mental time travel - Kano & Hirata (2015); Decision-making - Brosnan et al (2007); Metacognition: Ferrigno et al (2017).

- (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?

18. March 19: 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*.

19. March 21: 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

20. March 26: 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

21. March 28: **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, through 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

22. April 2: 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:

- Güntürkün & Bugnyar (2016). Cognition without cortex. *Trends in Cognitive Sciences*.
- Stulp et al (2009). Western scrub-jays conceal auditory information when competitors can hear but cannot see. *Biology Letters*.
- Wilkinson et al (2010). Gaze following in the red-footed tortoise (*Geochelone carbonaria*). *Animal Cognition*.

Reminder about response paper due April 9.

23. April 4: 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

Week 13: Reconstructing the minds of extinct species

RESPONSE PAPER 3: Cognitive Convergence. DUE MONDAY APRIL 9.

Pick one of the following species: foxes—Hare et al (2005); BIRDS – Stulp et al (2009), 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 *non-primate* species tell you about the evolution of the human mind?

24. April 9: Hominin brains and genes

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 and genetics.

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*.
- Herculano-Houzel (2012). The remarkable, yet not extraordinary, human brain as a scaled-up primate brain and its associated cost. *PNAS*.

QUIZ 10: Convergence

25. April 11: Hominin archeology

Some extinct creatures leave us additional clues to what they were thinking: they used tools, built graves, or wore decorations. This session will integrate approaches from the archeological record to examine human cognitive evolution

Readings:

- Haslam et al. (2009). Primate archaeology. *Nature*.
- Lewis & Harmond (2016). An earlier origin for stone tool making implications for cognitive evolution and the transition to *Homo*. *Philosophical Transactions*.
- Nowell (2010). Defining behavioral modernity in the context of Neanderthal and anatomically modern human populations. *Annual Review of Anthropology*.

Week 14: Human Uniqueness III

26. April 16: Wrap up: Why we need animals to understand human cognition

No readings.