

Psychology 330-02
Human Cognitive Evolution
Fall 2019: M-W 2-4:30
Room: East Quad / Residential College B852

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What is this course about?

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.

What are the objectives of this course?

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. My goal is that you will leave this class with two main skills:

1. A conceptual understanding of why and how scientists study animal cognition
2. A practical ability to read and understand empirical scientific papers

What are the pre-requisites for this course?

Pre-requisites for this course are at least one of the following courses, indicating some familiarity with psychology.

- Enforced pre-requisite: Psych 230 (Introduction to Behavioral Neuroscience)
- Alternative pre-requisites: Psych 240 (Introduction to Cognitive Psychology) or Psych 250 (Introduction to Developmental Psychology)

How are grades determined?

Your course grade will be determined by:

- Your participation in four class discussions (10%)
- Quizzes (10%)
- Three response papers (10% each; 30% total)
- A midterm (20%)
- A cumulative final (30%)

Where can I find readings and lecture slides?

- Readings are organized by class sessions (under Modules on the Canvas website).
- Pdfs of slides will be posted online in the relevant module after the lecture. Why after the lecture? A couple of reasons: (1) the answers to the quizzes are in the lectures; (2) I sometimes change the order of material during the sessions to respond to student comments, so I post slides that reflect what you actually saw in the lecture.

What are the readings for?

Each session will be paired with 2-3 readings consisting of a mixture of empirical articles and review chapters; all readings be posted electronically.

The readings in this class serve two purposes:

1. To complement and deepen your understanding of concepts covered in lecture.
2. To develop your skills reading, understanding, and constructively critiquing empirical scientific papers

What are lectures and discussion sessions like?

Most sessions consist of lectures, and students are expected to attend lectures. **Four 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-ups:* If you have a **documented** reason for missing a discussion session (letter from doctor or LSA advisor documenting illness or emergency; letter from another professor, advisor, or coach documenting 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.

How do quizzes work?

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. ***Please note that specific dates for quizzes are subject to change if the course schedule changes.***

- *Grading:* Quizzes will be graded with a 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).
- *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. Some basic subtraction therefore reveals you get two freebies--yay! 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).

How do response papers work?

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

- *Instructions:* Guidelines for specific response papers will be posted on Canvas.
- *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"
- *Deadline:* Your response paper must be uploaded to the Canvas website (under that assignment) **by 10PM on the day 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 10:01PM that day.**
- *Extensions:* If you have a **documented** reason for missing the paper deadline (letter from doctor or LSA advisor documenting illness or emergency), then you may be granted an extension. **This response paper will be due no later than 1 week after the original deadline**, except in cases of documented illness or emergency that preclude completion of the work in that timeframe. Extensions will not be granted because the deadline conflicts with work in other classes, electronic catastrophes, or the like—you should rather try to turn it in as soon as possible after the deadline to limit the number of points that get dropped and take this as a friendly, low-key life lesson in time management.

What about the midterm and final exam?

The midterm will be in class (see tentative date below in the course schedule), and there will be a final exam during the scheduled exam period for this class. ***Please note that the specific date for the midterm is subject to change if the course schedule changes.***

- *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 me at least two weeks 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.

What is the laptop and device policy for this course?

- *Short answer:* **No laptops or other devices are routinely allowed in this course.** Take notes on paper in class. Print out the readings for discussions. Welcome to the twentieth century!
- *Long answer:* You've probably heard the stats on how taking notes by hand can improve academic achievement. That's all great, but I view it as your decision (and/or responsibility) to use or ignore this kind of information. However, one side effect of your

decision to use a laptop or phone in class is that it can distract other people, and one of those other people it definitely does distract is me. Most students use computers in appropriate ways in class, but some do not. I have decided that the negative consequences (for all of you) of me being distracted by students using their devices in an unprofessional manner outweighs the value of each member of our course making an autonomous decision about using said devices. This has led me to switch to an 'analog' classroom.

- *What if you need to use a computer?* If you really need to use a computer to learn effectively, send me an email with a paragraph stating your case. (Hint: "I want to use a computer" is not an effective argument). I will then ask you to vigilantly make sure you only use the computer for class-related notes, not internet, chatting, etc. ***Specific accommodation needs for computer use will of course always be met: see below for course accommodation policy.***
- *What about phones?* I think you will be hard-pressed to convince me that you need a phone to learn effectively, but you are welcome to try!

Does this course have an academic Integrity policy?

Yes! First off, discussion and the exchange of ideas are essential to academic work. For response papers or other assignments in this course, you are encouraged to consult with your classmates on the choice of paper topics and to share resources or help each other understand the papers. **However, you should ensure that *any written work you submit for evaluation, including exams and responses papers, 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 as relevant.

Does this course have an accommodation policy?

Yes! If you think you need an accommodation for a disability, please let me know at your earliest convenience. As soon as you make me aware of your needs, we can work with the Services for Students with Disabilities (SSD) office to help us determine appropriate academic accommodations. SSD (<http://ssd.umich.edu>) typically recommends accommodations through a Verified Individualized Services and Accommodations (VISA) form. Any information you provide is private and confidential and will be treated as such.

COURSE TOPICS AND READINGS BY WEEK

Week 1: Human Uniqueness I

1. Wednesday September 4: 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 ideas scientifically?

Introduction to course and objectives. No readings.

Week 2: Theory I

2. Monday September 9: Humans are a (weird) primate

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:

- Tomasello & Call (1997) *Primate cognition*. Chapter 1.
- Hill et al. (2009) The emergence of human uniqueness: Characters underlying behavioral modernity. *Evolutionary Anthropology*

3. Wednesday September 11: 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*.
 - Shettleworth (2010). *Cognition, Evolution, and Behavior*. Chapter 1 – Cognition and the study of behavior.
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Week 3: Theory II

4. Monday September 16: **CLASS DISCUSSION**—How is cognition measured?

How is behavior implemented in the mind and brain? This session will continue the topics discussed in the prior session with a focus on a practical understanding of how to measure cognition in non-verbal animals.

Readings:

- Rosati (2018) Chimpanzee cognition and the roots of the human mind. *Chimpanzees and Human Evolution*.
- Krupenye et al (2016) Great apes anticipate that other individuals will act according to false beliefs. *Science*.

5. Wednesday September 18: 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:

- Wilson (2007) *Evolution for everyone*. Chapters 3-10.
 - Mayr (2002) *What evolution is*. Chapter 2.
 - Losos (2001). Evolution: A lizard's tale. *Scientific American*.
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Week 3: Theory III

6. Monday September 23: 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.

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

7. Wednesday September 25: 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:

- MacLean et al. (2012). How does cognition evolve? Phylogenetic comparative psychology. *Animal Cognition*.
 - Huebner et al (2018) Linking cognition with fitness in a wild primate: fitness correlates of problem-solving performance and spatial learning ability. *Philosophical Transactions*.
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Week 3: Social Cognition I

8. Monday September 30: 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.
- Drayton & Santos (2017) Do rhesus macaques, *Macaca mulatta*, understand what others know when gaze following? *Animal Behaviour*.
- Sandel, MacLean, & Hare (2011) Evidence from four lemur species that ringtailed lemur social cognition converges with that of haplorhine primates. *Animal Behaviour*.

Instructions for first response paper, due Friday October 11

QUIZ 2: Comparative method

9. Wednesday October 2: 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:

- Gleitman & Newport (1995) Chapter 1: "The invention of language by children: Environmental and biological influences on the acquisition of language"
- Cheney & Seyfarth (1990) *How monkeys see the world*. Chapter 4 – Vocal Communication; Chapter 5 – What the vocalizations of monkeys mean.
- Bullinger et al (2011). Different social motives in the gestural communication of chimpanzees and human children. *Developmental Science*.

Week 6: Social cognition II

10. Monday October 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*.

QUIZ 3: Theory of mind

11. Wednesday October 9: **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*.

Response paper 1: Primate social cognition. DUE FRIDAY OCTOBER 11 at 10PM.

Pick one of the following: Theory of Mind – Drayton & Santos (2017); Communication: Bullinger et al (2011); Cooperation – Engelmann et al (2015).

Week 7: Social Cognition III

Monday Oct 14: **** No Class: FALL BREAK****

12. Wednesday October 16: Tools and culture

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 do other species use tools, how do they learn to do so, and are these behaviors “cultural”?

Readings:

- van Schaik (2016). *The Primate Origins of Human Nature*. Chapter 9 – The evolution of technology.
- Mendes et al (2007). Raising the level: orangutans use water as a tool. *Biology Letters*.
- Csibra & Gergely (2011). Natural pedagogy as an evolutionary adaptation. *Philosophical Transactions of the Royal Society B*.

QUIZ 4: Cooperation

Week 8: Social Cognition IV and Midterm

13. Monday Oct 21: 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*.
- Goossens et al (2008). Gaze following in monkeys is modulated by observed facial expression. *Animal Behaviour*.

Wednesday October 23: ** Midterm (covers topics through **week 8**)

Week 9: Ecological Cognition I

14. Monday October 28: 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?”

Readings:

- Clayton et al. (2003) Can animals recall the past and plan for the future? *Nature Reviews Neuroscience*.
- Kano & Hirata (2015). Great apes make anticipatory looks based on long-term memory of single events. *Current Biology*.

Instructions for second response paper, due Friday November 8

15. Wednesday October 30: Decision-making

The last few decades of research in psychological and behavioral economics indicates that humans can be quite irrational when making decisions. Do other species show similar biases? What can this tell us about defining rationality in humans?

Readings:

- Kacelnik (2006). Meanings of rationality. In: *Rational animals?*
- Santos & Rosati (2015). The evolutionary roots of human decision-making. *Annual Review of Psychology*.
- Brosnan et al. (2007). Endowment effects in chimpanzees. *Current Biology*.

QUIZ 5: Memory

Week 9: Ecological Cognition II

16. Monday November 4: **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*.

17. Wednesday November 6: Metacognition and consciousness

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*.
- Beran et al (2013) Language-trained chimpanzees (*Pan troglodytes*) name what they have seen, but look first at what they have not seen. *Psychological Science*.

QUIZ 6: Decision-making

Response paper 2: Primate ecological cognition. DUE FRIDAY NOVEMBER 8 at 10PM.

Pick one of the following: Memory and mental time travel - Kano & Hirata (2015); Decision-making - Brosnan et al (2007); Metacognition: Beran et al (2013).

Week 10: Development

18. Monday November 11: 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 (2002). "Understanding the psychological world: Developing a theory of mind." In: *Handbook of Childhood Cognitive Development*.
- Spelke & Kinzler (2007). Core knowledge. *Developmental Science*.

19. Wednesday November 13: Life history and 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*.
- Kaplan et al. (2000) A theory of human life history evolution: Diet, intelligence, and longevity. *Evolutionary Anthropology*.

QUIZ 7: Metacognition

Week 11: Convergent evolution I

20. Monday November 18: 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*.

QUIZ 8: Life history and development

Instructions for third response paper, due Friday December 6.

21. Wednesday November 20: **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:

- Miklosi et al (2003) A simple reason for a big difference: Wolves do not look back at humans, but dogs do. *Current Biology*.
- Topal et al (2009). Differential sensitivity to human communication in dogs, wolves, and human infants. *Science*.
- 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. Monday November 25: Birds and reptiles

Is being accused of having a birdbrain actually an insult? This lecture will cover recent evidence for sophisticated behavior and cognition in 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*.
- Kabadayi & Osvath (2017). Ravens parallel great apes in flexible planning for tool-use and bartering. *Science*.
- Wilkinson et al (2010). Gaze following in the red-footed tortoise (*Geochelone carbonaria*). *Animal Cognition*.

QUIZ 9: Domestication

Wednesday November 27: ****No Class****

Week 13: Convergent evolution III and Extinct Species I

23. Monday December 2: 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*.

24. Wednesday December 4: 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:

- Preuss (2017) “The human brain: Evolution and distinctive features.” From: *On Human Nature*.
- Enard (2016) The molecular basis of human brain evolution. *Current Biology*.

QUIZ 10: Convergence

RESPONSE PAPER 3: Cognitive Convergence. DUE FRIDAY DECEMBER 6 AT 10PM.

Pick one of the following species: foxes—Hare et al (2005); BIRDS – Kabadayi & Osvath (2017), or elephants—Plotnik et al (2011).

Week 14: Extinct Species II and Human Uniqueness III

25. Monday December 9: 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:

- 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*.

26. Wednesday Dec 11: Wrap up: Why we need animals to understand human cognition

No readings.