UN3450/4450 Syllabus FALL 2026

Professor Herb Terrace
418 Schermerhorn Hall
terrace@columbia.edu
212-854-4544

Seminar meets on THURSDAYS afternoons (2:10-4:00) in 828 Uris Hall. Office hours: Thursday, 10-11 AM, and other times to be announced.

This seminar will systematically review the implications of Darwin's theory of evolution for contemporary studies of animal and human cognition, with particular emphasis on the evolution of language.

Format of the course: Each student will lead a seminar on a topic of their choice, selected from the following list.

1.	September	10	INTRODUCTION
2.	September	17	READING PERIOD (Prep. for October 1 seminar)
3	September	24	READING PERIOD (Prep. for October 8 seminar)
4.	October	1	READING PERIOD (Prep. for October 15 seminar)
5.	October	8	THEORY OF EVOLUTION
6.	October	15	CONDITIONED BEHAVIOR
7.	October	22	ANIMAL & PRIMATE COGNITION
8.	October	29	ANIMAL COMMUNICATION & APE LANGUAGE
9.	November	5	WALLACE'S PROBLEM & INFANT CONDITIONING
10.	November	12	HUMAN COGNITION & ARTIFICIAL INTELLIGENCE
11.	November	19	HUMAN ANCESTORS & ORIGIN OF COOPERATION
	November	**2-3**	**Thanksgiving Day Break**
12.	December	1	INTERSUBJECTIVITY & JOINT ATTENTION
13.	December	8	PROTOLANGUAGE & POINTING

All assigned readings, in PDF format, will be posted one week before each seminar. All students (except the presenter) are asked to submit one or two questions about the assigned readings by **email by 6 pm** on the **Monday** before each seminar. Those questions will help the presenter focus on his/her topic.

Grades, on a 100-point scale, will be calculated as follows:

Seminar presentation:	40 points
Seminar participation:	10 points
Written questions on readings:	10 points
Take home exam:	40 points

Grades for seminar participation will be calculated as follows: 10 points for submitting questions about assigned readings each week, and 10 points for participating in discussions of seminar topics.

To ensure that students have adequate time to prepare their seminars, I will meet with students who have chosen one of the earlier topics as needed during the first few weeks of the semester. The purpose of those meetings is to provide a basis for preparing the seminar. I will, of course, also meet with all students prior to their seminars. I envision at least 2 meetings with each student. Please schedule an appointment to meet with me at least three weeks before your topic's scheduled date.

There will be eleven seminars. I intend to cover all the topics, but in some cases, two students may be assigned to lead a seminar on a particular date. How this works will be determined by individual preferences discussed during the first seminar meeting on September 10th and by the number of students who actually enroll in the course.

Background reading. I will assign readings for each student to ensure that he/she can lead a discussion on that topic. Readings could include those listed on the following pages and others you would like to add.

Selection of assigned readings for the seminar. These readings (all in PDF format) will be circulated at least one week before each seminar.

Preparation of an outline for the talk. After discussing those aspects of a particular topic to be highlighted in the seminar, each student will be asked to prepare a 1-2-page outline for their seminar.

Annotated bibliography. Each student should select 2-3 readings that were especially helpful for his/her talk and summarize in a short paragraph what was special about that reading. The annotated bibliography should ***NOT*** be in the format of a book report. Instead, it should provide commentary about the innovation, incisiveness, brilliance, etc., of a particular reading. These bibliographies will be helpful for each student while they work on a take-home exam.

***Seminar outline**:* The leader(s) of each topic will distribute his/her outline before their seminar.

Circulation of Annotated Bibliographies and PowerPoint Presentations: Be sure to circulate an annotated bibliography for your talk on the day on which you present it. These are usually helpful for students preparing their take-home exams. For the same reason, it would be helpful to circulate your PowerPoint presentation if you used one.

***Mid-semester evaluation*:** Before each seminar, students will be required to submit 1-2 questions about the assigned readings. These questions will be graded on a pass/fail basis and will contribute to the student's score on "seminar participation". At the middle of the semester, students' questions will be used to assess their progress in the seminar.

Take-home exam: About 3 weeks before the end of the seminar, I will distribute an essay exam covering the topics discussed in this seminar. The exam will be due one week after final exams begin.

Copy of recent take-home exam:

Write a critical essay on the evolution of intelligence and language that addresses the following issues.

- How do animal species differ qualitatively with respect to their intelligence?
- What evidence is there that animals think without language?
- Are computers conscious and/or intelligent?
- What are the roles of dyadic and triadic interactions on the development of language?
- How did language evolve from animal communication? Your answer should comment on the significance of Wallace's problem.

Your paper should be ~10-20 double-spaced pages. When I grade it, I will be concerned with:

1. The clarity of your arguments about the positions you take on each issue focuses on the degree to which you agree with my position (or with anyone else's).
2. Your ability to include information from your own reading and from seminar discussions

Each question should be answered separately (1-2 double-spaced pages). Please be sure to attach both a bibliography and an annotated bibliography. Your bibliography should document each point you make, where relevant. Your **annotated bibliography** should contain ~5 references that you thought were particularly helpful.

Please review the topics that will be covered before we meet on September 10 to ensure they are what you expected.

Introduction: Discussion of rationale for each week's topic.

Evolution: One of biology's great mysteries is how language developed from animal communication. All animals communicate, but only humans use language. Given the limited overlap between the involuntary expressions of a narrow range of animal emotions and the voluntary exchange of unlimited amounts of information between humans, some scientists refer to the evolution of language as the "hardest problem of science"[i].

Darwin: The theory of evolution, natural selection, mutations, genetic drift and other bases for changes of species. Peculiar to the study of language is the dyad of the speaker and the listener. Another question is, what has to be explained; just the origin of words and grammar, or related factors such as cooperation?

Ayala, F. (2008). Science, evolution and creationism. *Proceedings of the National Academy of Sciences USA, 105*, 3-4.

Dawkins, R. (1976). The Selfish Gene. New York, NY, Oxford University Press.

Wallace's problem: Wallace, the co-founder of the theory of evolution, disagreed with Darwin after originally agreeing that biological typically result from natural selection. Wallace asked why language evolved given that it "was more than nature needs", specifically, how did language insure survival?

Bickerton, D. (2014). *More Than Nature Needs: Language, Mind, and Evolution*. Cambridge, MA: Harvard University Press (Chapter 1).

Levinson, S. (2014). Language and Wallace's problem. *Science, 344*(6191), 1458-1459.

Ape language experiments: Why non-spoken languages were used to train chimpanzees to communicate. Why attempts to teach them a gestural language (American Sign Language) and artificial visual languages failed. The importance of considering imperatives (as opposed to declaratives) and rotely-learned sequences as purported instances of language.

Gardner, B. T., & Gardner, R. A. (1969). Teaching sign language to a chimpanzee. *Science, 162*, 664-672.

Premack, D. (1971). Language in chimpanzees. *Science, 172*, 808-822.

Terrace, H. (2019). *Why chimpanzees can't learn language and only humans can*. New York: Columbia University Press. (Chapter 2).

Pre-human ancestors – Chimpanzees → Homo erectus: Chimpanzees are our closest living ancestors. At the start of the ape language experiments, little was known about other ancestors. During the last 40 years, many additional ancestors were discovered. Some are more plausible candidates for originating language than chimpanzees because of the shift from a quadrupedal to a bipedal gait, an increase

in brain size, changes in dietary requirements and the beginning of stone tool technology.

Terrace, H. (2019). *Why chimpanzees can't learn language and only humans can*. New York: Columbia University Press. (Chapter 3).

Wood, B. (2005). *Human evolution. A very short introduction*. New York: Oxford University Press.

Pre-human ancestors (continued) – Homo habilis → Homo sapiens: To continue this discussion, we will read selected excerpts from the following texts:

Dawkins, R. (2004). The ancestor's tale. New York: Houghton Mifflin.

Klein, R. (1989). *The human career: Human biological and cultural origins*. Chicago: University of Chicago Press.

Lewin, R. (2005). *Human evolution: an illustrated introduction*. Malden, MA: Blackwell.

Human Memory & AI:

Atkinson, R. C. and R. M. Shiffrin (1971). "The control of short-term memory." Scientific American **225**(2): 82–90.

Searle, J. (1990). "In the Brain's Mind a Computer Program?" Scientific American **262**: 26–31.

Infancy

04-Piaget.doc

Cooperative breeding: Most scholars of language evolution recognize that the first use of language, in particular words, presupposed an unusual ability to cooperate. Psychologists and biologists have written extensively about the origin of cooperation, particularly above the level observed in apes. In this seminar, I will focus mainly on Hrdy's view that cooperative breeding was needed to achieve that level of cooperation. With cooperative breeding, a natural mother allows kin, and other peers, to look after a newborn infant, -a practice that is diametrically opposed to that observed in apes, where a mother wouldn't allow anyone to attend to an infant until she is six months old. Infants reared by collective reading attempt to solicit more care from various mothers (alloparents), as compared to that obtained from a natural mother. Hrdy argues that collective breeding in human ancestors in particular, in *Homo erectus*. was crucial in their learning to share food (a necessary condition for the caloric requirements of their large brains) and, ultimately, and in naming food sources that had to be cooperatively scavenged.

Burkart, J. M., Hrdy, S. B., Van Schaik, C. P. (2009). Cooperative Breeding and Human Cognitive Evolution. *Evolutionary Anthropology, 18*, 175-186.

Hrdy, S. (2009, October 10). How humans became such other-regarding apes. Retrieved from http://onthehuman.org/2009/08/how-humans-became-such-other-regarding-apes.

Hrdy, S. B. (1999). *Mother nature: A history of mothers, infants, and natural selection*. New York: Pantheon Books.

Hrdy, S. B. (2005). Cooperative Breeders with an Ace in the Hole. In E. Voland, Chasiotis, A., Schiefenhovel, W. (Ed.), *Grandmotherhood: The Evolutionary Significance of the Second Half of Female Life* (pp. 295-311): Rutgers University Press.

Intersubjectivity: Because of a reduction in the size of the pelvis, the volume of the brains of human infants at birth is reduced relative to that of other ancestors. Because of their limited mobility, human infants must be cradled until they are 6 months old. That arrangement allows infants and mothers to gaze into each other's eyes more so than in other primates. That is the basis of an intense exchange of affect between an infant and her mother, starting at birth. As recent research by developmental psychologists shows, this *dyadic* relation, called intersubjectivity, gives rise to many rhythmic exchanges of sound and bodily movement between mother and infant. Evidence of intersubjectivity can be observed shortly after birth.

Terrace, H. (2019). *Why Chimpanzees Can't Learn Language And Only Humans Can*. New York: Columbia University Press. (Chapter 4, first part)

Joint attention: Once an infant begins to crawl, she comes into contact with many objects in her environment and often picks them up or points to them to draw a parent's attention. The *triadic* relation among an infant, a parent, and an object gives rise to a cognitive interaction between the infant and her parent, which adds to previously established nonverbal interactions during intersubjectivity. Once an infant and a parent can share attention to an object, it is relatively easy to attach a name to that object. In hindsight, the reason why chimpanzees could not learn to name objects is their lack of a history of intersubjectivity and joint attention.

Bruner, J. S. (1983). *Child's Talk: learning to use language*. New York, NY: W.W. Norton.
Terrace, H. (2019). *Why Chimpanzees Can't Learn Language And Only Humans Can*. New York: Columbia University Press (Chapter 4, second part).

Phylogenetic and Ontogenetic Origins of Words: Bickerton was one of the few linguists to specifically address the origin of words and the first to consider Wallace's problem in explaining the evolution of language. His was the most reasonable explanation of the origin of words (protolanguage) and, hence, the first step in explaining the evolution of language by natural selection. Bickerton's hypothesis about the use of words and scavenging by Homo erectus is the only answer to Wallace's problem that depends on natural selection. Other explanations, such as pair bonding, hunting, and making tools, fail that test.

Bickerton, D. (2014). *More Than Nature Needs: Language, Mind, and Evolution*. Cambridge, MA: Harvard University Press (Chapters 3 & 4).
Bickerton, D., Szathmary, E. (2011). Confrontational scavenging as a possible source for language

There is general agreement that words evolved before grammar both phylogenetically and ontogenetically. There is also general agreement that initial word

learning requires a foundation of intersubjectivity and joint attention. As discussed by Bruner, Bloom, McNamara, and Tomasello, initial word learning follows from shared intentionality.

Bloom, P. (2000). *How Children Learn the Meanings of Words*. Cambridge: The MIT Press
Bruner, J. S. (1983). *Child's Talk: learning to use language*. New York, NY: W.W. Norton.
Macnamara, J. (1972). Cognitive basis of language learning in infants. *Psychological Review, 79*(1), 1-13.
Tomasello, M. (1999). *The Cultural Origins of Human Cognition*. London: Harvard University Press

What is a Word?

Burling, R. (2011). Words came first: adaptations for word-learning. In K. R. Gibson & M. Tallerman (Eds.), *The Oxford Handbook of Language Evolution*. Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199541119.013.0044

Bergelson, E., & Aslin, R. (2017, 11/20). Nature and origins of the lexicon in 6-mo-olds. *Proceedings of the National Academy of Sciences, 114*, 201712966. https://doi.org/10.1073/pnas.1712966114

Bergelson, E., & Swingley, D. (2012, 02/28). At 6–9 months, human infants know the meanings of many common nouns. *Proceedings of the National Academy of Sciences of the United States of America, 109*, 3253-3258. https://doi.org/10.1073/pnas.1113380109

Clark, E. V. (1973). WHAT'S IN A WORD? ON THE CHILD'S ACQUISITION OF SEMANTICS IN HIS FIRST In T. E. Moore (Ed.), *Cognitive Development and Acquisition of Language* (pp. 65-110). Academic Press. https://doi.org/https://doi.org/10.1016/B978-0-12-505850-6.50009-8

Gervain, J., & Mehler, J. (2010, 02/01). Speech Perception and Language Acquisition in the First Year of Life. *Annual Review of Psychology, 61*, 191-218. https://doi.org/10.1146/annurev.psych.093008.100408

Greenfield, P. M., Lyn, H., & Savage-Rumbaugh, E. S. (2008). Protolanguage in ontogeny and phylogeny: Combining deixis and representation. *Interaction Studies, 9*(1), 34-50. https://doi.org/https://doi.org/10.1075/is.9.1.04gre

Levinson, S. C., & Holler, J. (2014). The origin of human multi-modal communication. *Phil. Trans. R. Soc. Lond. B, 369*(1651). https://doi.org/10.1098/rstb.2013.0302

Premack, D. (1990). Words: what are they, and do animals have them? *Cognition, 37*, 197-212.

Students with Disabilities: Students with special needs who may require classroom/assignment accommodations should make an appointment with me before or during the first week of class. You should also contact the Office of Disability Services (ODS) in Lerner Hall before the start of the course to register for these accommodations. The procedures for registering with ODS can be found here: https://health.columbia.edu/services/register-disability-services

Academic integrity: As members of this academic community, we are responsible for maintaining the highest level of personal and academic integrity: "[E]ach one of us bears the responsibility to participate in scholarly discourse and research in a manner characterized by intellectual honesty and scholarly integrity.... The exchange of ideas relies upon a mutual trust that sources, opinions, facts, and insights will be properly noted and carefully credited. In practical terms, this means that, as students, you must be responsible for the full citations of others' ideas in all of your research papers and projects... [and] you must always submit your own work and not that of another student, scholar, or internet agent" (from the Columbia University Faculty Statement on Academic Integrity).

During your work for this course, please keep in mind the following Faculty Rules regarding academic integrity.

The intellectual venture in which we are all engaged requires of faculty and students alike the highest level of personal and academic integrity. As members of an academic community, each one of us bears the responsibility to participate in scholarly discourse and research in a manner characterized by intellectual honesty and scholarly integrity.

Scholarship, by its very nature, is an iterative process, with ideas and insights building one upon the other. Collaborative scholarship requires the study of other scholars' work, the free discussion of such work, and the explicit acknowledgement of those ideas in any work that influence our own. This exchange of ideas relies upon a mutual trust that sources, opinions, facts, and insights will be properly noted and carefully credited.

In practical terms, this means that, as students, you must be responsible for the full citations of others' ideas in all of your research papers and projects; you must be scrupulously honest when taking your examinations; you must always submit your work and not that of another student, scholar, or internet agent.

Any breach of this intellectual responsibility is a breach of faith with the rest of our academic community. It undermines our shared intellectual culture, and it cannot be tolerated. Students failing to meet these responsibilities should anticipate being asked to leave Columbia.