COGS50.11 • Logic in Language and Thought

Spring 2025

Instructor:	Caleb Kendrick	**Time:**	TBD
Office Hours:	TBD Raven 105	**X-hour:**	TBD
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Objectives: Languages universally do not lexicalize certain concepts–no natural language contains a color term meaning "red or green," an operation which expresses logical NAND (i.e., a binary operation which returns false when both inputs are true) or a quantifier meaning "between 2 and 7." In recent years, work in developmental psychology, psycholinguistics, and computational linguistics has converged several hypotheses to explain these universals–according to one hypothesis, languages only lexicalize the expressions which maximize the tradeoff between complexity and informativeness, while according to another hypothesis languages only lexicalize the expressions which are the easiest to learn. In this course, we will explore these hypotheses with a particular focus on quantifiers, expressions like *some*, *all*, *many*, and *most*.

Course materials: The readings from this class will be taken from the following textbook supplemented with additional articles. I will provide PDFs of all supplemental course materials. Since we will be reading from it most weeks, you should consider purchasing the book:

Szymanik, Jakub (2016). *Quantifiers and cognition: Logical and computational perspectives* (Vol. 96). Cham: Springer.

Grading:

- Problem sets (25%)
- 2 response papers (≈ 500 words) (30%)
- Final paper or project (8-10 pages for an individual; 12-15 page for a group) (30%)
- Attendance and class participation: (15%)

Response papers should focus on one point in the material that you would like to respond to or expand upon. Responses could take either a critical perspective, laying out reasons for doubting the arguments made in the material, and the evidence in support of your counterargument. Both theoretical and empirical evidence is fair game. Responses can also take a more positive perspective, expanding upon the arguments presented in the material and extending them either theoretically or empirically. **These should not be summaries** of the material you are responding to.

Group projects will either consist of a review of an area related to the course not explicitly covered in the first part of the course, or a grant proposal for a novel experiment. Groups should consist of 4-5 people. These topics should be cleared with me before proceeding.

Academic Honesty: The faculty, administration, and students of Dartmouth College acknowledge the responsibility to maintain and perpetuate the principle of academic honor, and recognize that any instance of academic dishonesty is considered a violation of the Academic Honor Principle.

Religious Accommodations: Dartmouth has a deep commitment to support students' religious observances and diverse faith practices. Some students may wish to take part in religious observances that occur during this academic term. If you have a religious observance that conflicts with your participation in the course, please meet with me as soon as possible—before the end of the second week of the term at the latest—to discuss appropriate course adjustments.

Disability Accommodations: Students requesting disability-related accommodations and services for this course are required to register with Student Accessibility Services (SAS; Apply for Services; student.accessibility.services@dartmouth.edu; 1-603-646-9900) and to request that an accommodation email be sent to me in advance of the need for an accommodation. Then, students should schedule a follow-up meeting with me to determine relevant details such as what role SAS or its Testing Center may play in accommodation implementation. This process works best for everyone when completed as early in the quarter as possible. If students have questions about whether they are eligible for accommodations or have concerns about the implementation of their accommodations, they should contact the SAS office. All inquiries and discussions will remain confidential.

Mental Heath Resources: The academic environment is challenging, our terms are intensive, and classes are not the only demanding part of your life. There are a number of resources available to you on campus to support your wellness, including: the Counseling Center which allows you to book triage appointments online, the Student Wellness Center which offers wellness check-ins, and your undergraduate dean. The student-led Dartmouth Student Mental Health Union and their peer support program may be helpful if you would like to speak to a trained fellow student support listener. If you need immediate assistance, please contact the counselor on-call at (603) 646-9442 at any time. Please make me aware of anything that will hinder your success in this course.

Sexual and Gender-Based Misconduct: At Dartmouth, we value integrity, responsibility, and respect for the rights and interests of others, all central to our Principles of Community. We are dedicated to establishing and maintaining a safe and inclusive campus where all community members have equal access to Dartmouth's educational and employment opportunities. We strive to promote an environment of sexual respect, safety, and well-being. Through the Sexual and Gender-Based Misconduct Policy (SMP), Dartmouth demonstrates that sex and gender-based discrimination, sex and gender-based harassment, sexual assault, dating violence, domestic violence, stalking, etc., are not tolerated in our community.

For more information regarding Title IX and to access helpful resources, visit Title IX's website (sexualrespect.dartmouth.edu). As a faculty member, I am required to share disclosures of sexual or gender-based misconduct with the Title IX office.

If you have any questions or want to explore support and assistance, please contact the Title IX office at 603-646-0922 or TitleIX@dartmouth.edu. Speaking to Title IX does not automatically initiate a college resolution. Instead, much of their work is around providing supportive measures to ensure you can continue to engage in Dartmouth's programs and activities.

Financial Hardship Resources: If you encounter financial challenges related to this class, there may be sources of support for you. If you feel comfortable sharing your experience with me, you may. You may also consider meeting with a financial aid officer to discuss options, reaching out to the First-Generation Office if you are a first-generation student, browsing the Funding Resources page, or, for unexpected expenses, applying to the Barrier Removal Fund through the Financial Aid tile in DartHub.

Tentative Course Outline:

Week 1: Why do languages lexicalize some concepts rather than others?

Feldman, J. (2000). Minimization of Boolean complexity in human concept learning. *Nature*, 407(6804), 630-633.

Kemp, C., Xu, Y., & Regier, T. (2018). Semantic typology and efficient communication. *Annual Review of Linguistics*, 4(1), 109-128.

Optional readings:

Uegaki, W. (2023). The informativeness/complexity trade-off in the domain of Boolean connectives. *Linguistic Inquiry*, 55(1), 174-196.

Week 2: Generalized Quantifier Theory

Chapter 3 of Szymanik.

Barwise, J., & Cooper, R. (1981). Generalized quantifiers and natural language. *Linguistics and Philosophy*, 159-219.

Week 3: Quantifiers and psycholinguistics

Hunter, T., & Lidz, J. (2013). Conservativity and learnability of determiners. *Journal of Semantics*, 30(3), 315-334.

Knowlton, T., Trueswell, J., & Papafragou, A. (2022). New evidence for the unlearnability of non-conservative quantifiers. In *Proceedings of the 23rd Amsterdam Colloquium* (pp. 367-374).

Optional readings:

Chemla, E., Buccola, B., & Dautriche, I. (2019). Connecting content and logical words. *Journal of Semantics*, 36(3), 531-547.

Week 4: Computational representations of quantifiers

Chapter 4 of Szymanik.

Optional readings:

van Benthem, J. (1987). Towards a computational semantics. In Peter Gärdenfors (ed.), *Generalized Quantifiers*. Reidel Publishing Company. pp. 31–71

Week 6-7: Machine learning for quantifiers

Notes on neural networks. Steinert-Threlkeld, S., & Szymanik, J. (2020). Ease of learning explains semantic universals. *Cognition*, 195, 104076.

Steinert-Threlkeld, S. (2020). Quantifiers in natural language optimize the simplicity/informativeness trade-off. In *Proceedings of the 22nd Amsterdam Colloquium* (pp. 513-522).

Optional readings:

Steinert-Threlkeld, S., & Szymanik, J. (2019). Learnability and semantic universals. *Semantics and Pragmatics*, 12, 4-1.

Week 8: The mental representation of *most*

Pietroski, P., Lidz, J., Hunter, T., & Halberda, J. (2009). The meaning of 'most': Semantics, numerosity and psychology. *Mind & Language*, 24(5), 554-585.

Lidz, J., Pietroski, P., Halberda, J., & Hunter, T. (2011). Interface transparency and the psychosemantics of *most*. *Natural Language Semantics*, 19, 227-256.

Optional readings:

Odic, D., & Starr, A. (2018). An introduction to the approximate number system. *Child Development Perspectives*, 12(4), 223-229.

Week 9: The mental representation of universal quantifiers

Knowlton, T., Pietroski, P., Halberda, J., & Lidz, J. (2022). The mental representation of universal quantifiers. *Linguistics and Philosophy*, 45(4), 911-941.

Knowlton, T., Pietroski, P., Williams, A., Halberda, J., & Lidz, J. (2023). Psycholinguistic evidence for restricted quantification. *Natural Language Semantics*, 31(2), 219-251.

Optional readings:

Knowlton, T. Z., Pietroski, P., Williams, A., Halberda, J., & Lidz, J. (2020). Determiners are "conservative" because their meanings are not relations: evidence from verification. In *Semantics and Linguistic Theory* (pp. 206-226).