GESM 140g: Seminar in the Life Sciences
Science of Mind: Language
(Last modified: August 15, 2023)

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Course description

This course explores how the parts of the mind that deal with language (the language faculty) can be studied by hypothesis-formation, deduction of definite predictions, and obtaining and replicating experimental results precisely in line with such definite predictions. The overarching hypothesis that will be adopted is that the core properties of the language faculty is shared by all members of the human species, and this core part specifically includes a formal system (a Computational System of the language faculty).

The discussion about scientific methods will be based on an individual student's involvement in the process of hypothesis formation, the designing and conducting of experiments, analyses of experimental results, and most crucially participation in experiments themselves.

The main experiments we discuss in class are about individual speakers of English; if we have native speakers of other languages, we can discuss experiments in their own languages as well. The predictions being tested are deduced in part by hypotheses about an individual's language faculty, as a speaker of their native language, and they are about their linguistic judgments with regard to what are possible and impossible interpretations for sentences of a particular sentence pattern in that language. An individual speaker's linguistic judgments in question are affected not only by "formal factors" about the Computational System of the language faculty (CS) but also by "non-formal factors" outside the CS or even factors outside the language faculty proper.

This necessitates the controlling for effects of non-formal factors (noise control) so as to obtain accurate experimental results. Obtaining and replicating definite experimental results, in the form of definite speaker judgments—more precisely, in the form of definite correlations of patterns of linguistic judgments precisely in line with our predictions—is sought first within an individual student and then across students in class, and beyond. When we fail to obtain linguistic judgments as predicted by hypotheses, or fail to obtain replication of definite experimental results within a speaker or across speakers, we will formulate hypotheses (mostly) about non-formal factors (but possibly about formal factors as well), deduce and test new predictions based on such hypotheses.

Existing work detailing research replicating such predicted judgments beyond speakers of English will be discussed mainly in relation to Japanese, but, to a lesser degree, in relation to Mandarin Chinese and Korean. Students will learn certain properties of Japanese necessary for understanding Japanese-specific hypotheses, and also about how Japanese-specific hypotheses were formulated and tested for noise control, along with results of experiments in Japanese.

One of the key concepts is rigorous testability, and the course will address how our hypotheses lead to rigorously testable predictions about individual speakers; crucial difference between disconfirmable prediction and confirmable predictions will be discussed. The focus on the course is on individual speakers, rather than groups of speakers; it focuses on definite and categorical predictions about an individual

speaker's linguistic judgments, rather than the average of a group of speakers. This will be illustrated based on results of "large-scale" experiments, making reference to the distinction between factual knowledge (based on statistical inference) and comprehension (based on deducing, obtaining and replicating, a definite prediction) in the terms of Einstein's "Foreword"[1].

Except for sessions that are entirely devoted to in-class activities about experiments and/or hypothesis formation, each session will start with discussion about students' own linguistic intuitions, addressing how they are affected by various factors and how their effects can be controlled for, is followed by conceptual discussion, and will then return to issues addressed in the initial part of the session.

Overall, students will learn about basic aspects of scientific reasoning and experimentation, based on close investigation of linguistic intuitions of their own and of others. The biggest takeaway from the course is that we can accumulate knowledge about parts of the mind (the language faculty) by the scientific method, focusing on an individual speaker and replicating their linguistic judgments within speakers of the same linguistic community and beyond. The course does not require any prior experience of linguistics but it requires an inquisitive and critical mind.

Learning Objectives

Weeks	Learning Objectives: At the end of the period, students will be able to:
1-4[2]	State the object and the method of inquiry in LFS. State the hypotheses that lead to definite predictions about an individual speaker's linguistic judgments. State what observational tools will be used for testing the predictions.
5-6	Determine what choices of X and what choices of Y (of BVA(X, Y), DR(X, Y) and Coref(X, Y)) are effective probes for identifying c-command effects for a given speaker at a given time. This is about testing and confirming an existential prediction.
7-8	Test the correlational prediction (and its contrapositive) for a given speaker at a given time. This is about testing a disconfirmable (universal) prediction.
9-10	Construct new sentence patterns. Identify different sources of noise.
11-12	Construct new sentences based on the new choices of X and Y and new sentence patterns identified in Weeks 5-10. Design and conduct an experiment on oneself. Analyze results of an experiment on oneself.
13	Design and conduct an experiment on others. Analyze results of an experiment on others.
14	Report on the design and results of experiments on oneself and others.

By the end of this course, students will be able to design and conduct an experiment on themselves and on others, for c-command pattern identification and for c-command detection, and analyze results as disconfirming or confirming the predictions being tested.

Required Readings and Optional Readings
The readings mentioned in "Readings and Assignments" are required readings. The references mentioned in "Readings" but not mentioned in "Readings and Assignments" are not required but recommended.

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[1] Einstein, A., 1953/1967. "Foreword to the English translation of Galileo's Dialogue Concerning the Two Chief World Systems, University of California Press.

[2] These weeks are preliminary to Weeks 5-14 and are intended to provide students with conceptual and research-historical background to empirical and experimental discussion in Weeks 5-14.

Description and Assessment of Assignments
There are reading-related assignments and experiment-related assignments, as indicated in "Readings and Assignments". There are three sub-types of the former: (i) Answering questions raised by the instructor about the readings, (ii) Raising questions about the readings, and (iii) Answering selected questions raised by students. Assessment of the assignment is based on how solid an understanding of the reading materials a student has attained and their contribution to class discussion by raising questions about the readings that help students attain a better understanding of the reading materials.

Each experiment-related assignment is a task based on in-class activities; see the details in "Readings and Assignments", "Weekly Schedule", and "Learning Objectives". Students will start doing the task in question in class and they will complete the task in the assignment. In the case of class presentation, it will be based on in-class reports that will have taken place prior to the class presentation. Students are required to participate in on-line experiments twice in the semester. The on-line experiments are actually a pedagogical demonstration, where students will have the first experience of checking their own linguistic intuitions about the availability of meaning relations that will be discussed in depth in the rest of the semester. The actual empirical materials (sentences with meaning relations, with specific choices of X and Y) in the on-line "experiments" will be a small subset of what will be discussed in Weeks 5-14. Participation of the on-line "experiments" will place students in a good position to appreciate discussion later in the semester about results of the same "experiments" in the past, with over 1,000 participants, and also results of analogous "experiments" in Japanese, with close to 200 participants.

As long as you fully participate in the on-line experiments, and as long as you submit a brief report on what you found interesting and what they found confusing, you get full points for the on-line "experiments". The summary report on experiments to be submitted at the end of the semester should be based on the class presentation in Week 14, including feedback from students and the instructor. The instructor will inform students of what materials have to be added in the summary report, including, but not limited to, what follow-up experiments should be conducted on oneself and/or others and what type of discussion should be included for their analyses of experimental results.

Grading Breakdown
The course grades will be based on the assignments and reports as indicated below:

Experiment-related assignments (60)
- In-class activities-based assignments and class presentation (10x4=40) (Weeks 9-14))
- Summary report on experiments to be submitted at the end of semester (10)
- On-line experiment participation (twice) (5x2=10)

Reading-related assignments (40) (Weeks 1-8)
- Answering questions about the content of the assigned readings (5x4=20)
- Students raising questions about the assigned readings. (2.5x4=10)
- Students answering selected questions raised by students (2.5x4=10)

Course Grading Scale
Course grades will be determined based on the following scale.

A	94 or higher
A-	90 or higher and lower than 94
B+	87 or higher and lower than 90
B	84 or higher and lower than 87
B-	80 or higher and lower than 84
C+	77 or higher and lower than 80

C 74 or higher and lower than 77
C- 70 or higher and lower than 74
D+ 67 or higher and lower than 70
D 64 or higher and lower than 67
D- 60 or higher and lower than 64
F 59 and below
C- or higher counts as Pass for Pass/Non Pass.

Assignment Submission Policy
The due dates for each assignment will be announced, in line with "Readings and Assignments". Assignment is to be submitted by email to hoji@usc.edu.

Grading Timeline
Students can expect grading and feedback from the instructor within a week from the submission of the assignment.

Course Specific Policies
Late submission of assignments and reports will not be accepted without a very good reason (e.g. demonstrable illness or a life-changing event). Some experiment-related assignments require the use of Excel.

Weekly Schedule (LFS=Language Faculty Science)

Weeks	In-class activities	Lecture topics
1-2	Linguistic judgments in LFS	General introduction to LFS
	Ambiguity: *unlockable*, referential vs. bound uses of pronouns, sloppy-identity readings Pronoun vs. Names Effects of word orders on judgments	Object of inquiry and the method of inquiry Basic Scientific Method Sounds-meaning paring, Merge, c-command, and M(eaning) R(elation)s
3-4	Trying to obtain clear judgments	Different MRs as tools for investigating properties of the Computational System (CS) of the language faculty.
	BVA(X, Y): **B**ound **V**ariable **A**naphora: BVA(every boy, his/him), for example, is a particular M(eaning) R(elation) pertaining to *every boy* and *his/him* appearing in a sentence of various patterns. DR(X, Y): **D**istributive **R**eading: DR(every boy, three robots), for example, is a particular MR pertaining to *every boy* and *three robots* appearing in a sentence of various patterns. Coref(X, Y): **Coref**erene: Coref(John, his/him), for example, is a particular MR pertaining to *John* and *his/him* appearing in a sentence of various patterns, the one of referring to the same individual.	Hypotheses about FR(x, y), a **F**ormal **R**elation in the CS of the language faculty Different sources of MR(X, Y), other than FR(x, y) Predictions in LFS (1), without correlations, i.e., existential, and not disconfirmable, predictions Judgments on schemata, not on sentences
5-6	Judgmental fluctuation and variation	Seeking replication in LFS
	Different choices of X	The Computational System, the language faculty and what surrounds it

	Different choices of Y Other factors	Within-speaker replication Across-speaker replication
7-8	Correlations of judgments	Testability in LFS and correlational methodology Correlational prediction and its contrapositive
	Across-MR correlations Within-MR correlations	Predictions in LFS (2), with correlations, disconfirmable predictions Experiments in Japanese (and other languages)
9-10	More sentence patterns: Toward the designing of an experiment on oneself	Deduction of correlational but definite predictions
	Correlation between WCO and anti-locality Other sources of MR: BrQrk (pertaining to X of MR(X, Y), BeQrk (pertaining to Y of MR(X, Y)), precedence, and co-D	Exhaustively checking the possible sentence patterns Three variables determining sentence patterns 2x2x2=8 patterns where Y precedes X, 8 more patterns where X precedes Y Anti-locality condition on F(ormal)D(ependency), an instance of FR
11-12	Designing and conducting an experiment for oneself	Review of the significance of schematic asymmetries
	Constructing new sentences, based on new choices of X, Y and new schemata	
13	Designing and conducting an experiment on others	
14	Summary reports on experiments, in-class presentation	
15	Concluding remarks	Clarification about what has been simplified
		Self-experiments, non-self-experiments, and demonstration C-command pattern identification, and c-command detection The viewing of a 3D image out of a random-dot stereogram Detection of gravitational waves

Readings and Assignments

Weeks	Readings	Assignments
1-2	Chomsky 1959 Ch. 9: Sections 9.1 and 9.2 Feynman 1965/1994	Questions about the readings (5) Raising questions about the readings (2.5) Answering selected questions raised by students (2.5) On-line experiments #1 (the first week) (5)
3-4	Meehl 1967 Ch. 4 Popper 1963	Questions about the readings (5) Raising questions about the readings (2.5) Answering selected questions raised by students (2.5) On-line experiments #2 (the third week) (5)
5-6	Feynman 1985 Ch. 5 Plesniak 2023c Einstein 1936	Questions about the readings (5) Raising questions about the readings (2.5) Answering selected questions raised by students (2.5)
7-8	Schütze and Sprouse 2013, Ch. 6 Einstein 1953/1967	Questions about the readings (5) Raising questions about the readings (2.5) Answering selected questions raised by students (2.5)
9-10	Plesniak 2022a	Experiment-related (10)

	Ch. 7	Constructing schemata and sentences, based on particular choices of X and Y.
11-12	None	Experiment-related (10) The design and the result of an experiment on oneself, and discussion
13	None	Experiment-related (10) Report on the design and the result of an experiment on others, and discussion
14	None	Class presentation (10)
15	Chomsky 2017 Penrose 2004	
		Summary report on experiments to be submitted at the end of semester (10)

Readings

Chomsky, Noam. 1959. "A Review of B. F. Skinner's *Verbal Behavior*", in *Language*, 35, No. 1, 26-58.

Chomsky, Noam. 2017. "The Galilean Challenge," *Inference: International Review of Science*, Vol. 3. Issue 1.

Einstein, Albert. 1936. Physics and Reality. The Journal of the Franklin Institute; Reprinted in: *Ideas and Opinions*. 1955. Crown Publishers, New York. (The assigned reading is pp. 293-295.)

Einstein, Albert. 1953/1967. "Foreword to the English translation of *Galileo's Dialogue Concerning the Two Chief World Systems*, University of California Press. (The assigned reading is pp. xvii-xix)

Feynman, Richard. 1965/1994. *The character of physical law*. New York: The Modern Library. (The Feynman lectures based on which this book was prepared can be viewed on-line. If you Google "Feynman Messenger Lectures," you will find the seven lectures. The assigned reading is pp. 150-153, which is part of his seventh lecture ("Seeking New Laws") available at: http://www.youtube.com/watch?v=MIN_-Flswy0 (last accessed on 1/24/2023). The content of pp. 150-151 starts around 14:40 of that video.)

Feynman, Richard. 1985. "Cargo Cult Science", in *"Surely You're joking, Mr. Feynman": Adventures of a curious character*, W. W. Norton and Company, New York.

Hoji, H. 2017. "Galileo's Other Challenge." *Inference: International Review of Science*, Vol. 3. Issue 2.

Hoji, H, D. Plesniak, and Y. Takubo. (eds.) 2023 *The Theory and Practice of Language Faculty Science*, De Gruyter Mouton.

Hoji, H. "The key tenets of language faculty science", in Hoji et al. 2023. (This shall be referred to as "Ch. 4".)

Hoji, H. "Detection of c-command effects", in Hoji et al. 2023. (This shall be referred to as "Ch. 5".)

Hoji, H. "Replication: predicted correlations of judgments in Japanese", in Hoji et al. 2023. (This shall be referred to as "Ch. 6".)

Hoji, H. and D. Plesniak. "Language Faculty Science and Physics", in Hoji et al. 2023. (This shall be referred to as "Ch. 9".).

Meehl, E. Paul. 1967. "Theory testing in psychology and physics: a methodological paradox", *Philosophy of Science* 34: 103-115. (Reprinted in Morrison and Henkel 1970/2007. The page reference is to Morrison and Henkel 1970/2007.)

Penrose, Roger. 2004. *The Road to Reality: A Complete Guide to the Laws of the Universe*, Jonathan Cape. (The required reading is Chapter 1: Section 1.4, but you will find it useful to read the rest of the chapter.)

Plesniak, Daniel. 2022a. "Building the Linguistic Telescope". February 2022. Talk given at the Second Annual Workshop on Language Faculty Science. Online.

Plesniak, Daniel. 2023a. "Predicted Correlations of Judgments in English", in Hoji et al. 2023. (This shall be referred to as "Ch. 7".)

Popper, Karl. 1963. "Science: Problems, aims, responsibilities", Federation Proceedings (Baltimore), *Federations of American Societies of Experimental Biology* 22.4: 961-972.
Schütze, Carson and Jon Sprouse. 2013. "Judgment Data", in Robert J. Podesva and Devyani Sharma, eds., *Research Methods in Linguistics*, Cambridge University Press, Cambridge, 27-50.

Other References

Chomsky, Noam. 1975. *Reflections on Language*. Pantheon, New York.
Chomsky, Noam. 2004. *The Generative Enterprise Revisited*, Mouton de Gruyter, Berlin.
Chomsky, Noam. 2012. *The Science of Language: Interview with James McGilvray*, Cambridge University Press, Cambridge.
Duhem, Pierre. 1906/1954. *The aim and structure of physical theory*, Princeton University Press, Princeton. (The original publication in French in 1906, its original English translation in 1954, and its renewed edition in 1982.)
Einstein, Albert., 1936. Physics and Reality. The Journal of the Franklin Institute; Reprinted in: *Ideas and Opinions*. 1955. Crown Publishers, New York.
Feynman, Richard. 1963. *Six Easy Pieces*, Basic Books, New York.
Feynman, Richard. 1965/1994. *The character of physical law*, The Modern Library, New York.
Feynman, Richard. 1999. *The Pleasure of Finding Things Out*, Basic Books, New York. (The suggested readings are pp. 22-23 and pp. 108-109. What is in pp. 22-23 can be viewed at: https://www.youtube.com/watch?v=tWr39Q9vBgo&t=7s (last accessed on 1/24/2023).)
Hoji, Hajime. 2015. *Language Faculty Science*. Cambridge University Press.
Hoji, Hajime, Satoshi Kinsui, Yukinori Takubo and Ayumi Ueyama. 2003. "The demonstratives in modern Japanese", In Yen-Hui Audrey Li and Andrew Simpson (eds.), *Functional structure(s), form and interpretation*, 97–128. New York: Routledge.
Lasnik, Howard. 1990. "Syntax", in D. N. Osherson and H. Lasnik eds., *Language: An Invitation to Cognitive Science Volume 1*, A Bradford Book, The MIT Press, Cambridge, pp. 5-21.
Plesniak, Daniel. 2022b. *Towards a Correlational Law of Language: Three Factors Constraining Judgment Variation*. Los Angeles: University of Southern California PhD dissertation.
Plesniak, Daniel. 2023b. "Implementing Experiments on the Language Faculty", in Hoji et al. 2023. (This shall be referred to as "Ch. 8".)
Plesniak, Daniel. 2023c. "C-command and Beyond: The Emerging Universe of Formal and Non-Formal Relations", *The Korean Journal of Linguistics* (언어), 48(2), 315-366.
Poincaré, Henri. 1952. *Science and hypothesis*. New York: Dover Publications. (The English translation of *La science et l'hypothèse* (1902).)
Schütze, Carson. 1996. *The empirical base of linguistics: Grammaticality judgments and linguistic methodology*, University of Chicago Press, Chicago.

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This course will follow the expectations for academic integrity as stated in the USC Student Handbook. All students are expected to submit assignments that are original work and prepared specifically for the course/section in this academic term. You may not submit work written by others or

"recycle" work prepared for other courses without obtaining written permission from the instructor(s). Students suspected of engaging in academic misconduct will be reported to the Office of Academic Integrity.

Other violations of academic misconduct include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

The impact of academic dishonesty is far-reaching and is considered a serious offense against the university and could result in outcomes such as failure on the assignment, failure in the course, suspension, or even expulsion from the university.

For more information about academic integrity see the student handbook or the Office of Academic Integrity's website, and university policies on Research and Scholarship Misconduct.

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Academic Integrity:
The University of Southern California is a learning community committed to developing successful scholars and researchers dedicated to the pursuit of knowledge and the dissemination of ideas. Academic misconduct, which includes any act of dishonesty in the production or submission of academic work, comprises the integrity of the person who commits the act and can impugn the perceived integrity of the entire university community. It stands in opposition to the university's mission to research, educate, and contribute productively to our community and the world.

All students are expected to submit assignments that represent their own original work, and that have been prepared specifically for the course or section for which they have been submitted. You may not submit work written by others or "recycle" work prepared for other courses without obtaining written permission from the instructor(s).

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Please ask your instructor if you are unsure what constitutes unauthorized assistance on an exam or assignment, or what information requires citation and/or attribution.

Students and Disability Accommodations:
USC welcomes students with disabilities into all of the University's educational programs. The Office of Student Accessibility Services (OSAS) is responsible for the determination of appropriate accommodations

for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at osas.usc.edu. You may contact OSAS at (213) 740-0776 or via email at osasfrontdesk@usc.edu.

Support Systems:
The Student Resources page is found at: https://sites.google.com/view/uscphongroup/usc-support