The Chinese University of Hong Kong
Department of Linguistics and Modern Languages
Second Term, 2023-24

Course Code: LING4202
Title in English: Special Topics in Language and Mind — Paradigms in Language Sciences
Title in Chinese: 語言與心智專題 – 語言科學研究範式

Course description:
This course introduces students to the paradigms and research methods commonly used in language sciences. Students will learn about various experimental approaches in psycholinguistics and neurolinguistics, including popular behavioral paradigms such as grammaticality judgment, priming, visual world, and neuroimaging techniques like Electroencephalogram (EEG) and functional near-infrared spectroscopy (fNIRS). We will also cover state-of-the-art large language models such as GPT and explain how these models can contribute to language research. Through examples of behavioral and neuroimaging studies, students will gain an understanding of how these paradigms and techniques can be used to answer important questions about language and the mind. Students will also learn about research ethics, design, planning, and implementation, as well as conduct classic behavioral and neuroimaging experiments related to language processes, such as semantic and syntactic processes. This course is suitable for both undergraduate and junior graduate students at different stages of their study. It aims to help students develop the skills and strategies necessary for understanding and conducting empirical language research.

Learning outcomes:
At the end of the course, students will be able to

- have a good understanding of research designs and methods in language sciences
- describe the pros and cons of classic paradigms
- have a better understanding of how to measure appropriate variables and collect reliable data for empirical research
- understand the logic of classic behavioral experimental paradigms
- accurately describe behavioral and neuroimaging methods used in language research
- understand the basic principle of EEG and fNIRS signals and the recording procedures
- understand basic statistical approaches and the practical skills to apply them to the actual data
- write lab reports to describe the methods and results of a behavioral/EEG/fNIRS experiment

Course syllabus

Topic	Contents/fundamental concepts
Language sciences as an empirical science	Aims of language sciences, essential empirical research background, scientific approaches, hypothesis testing, etc.
Overview of experimental methods in language sciences	Quantitative approaches and research design: correlational design, cause-effect design, cross-sectional and longitudinal design, within/between-subject design, basic stat, etc.
Offline and online paradigms used in experimental linguistics	Introducing classic behavioral paradigms (e.g., grammaticality judgment, priming, visual world paradigm for eye tracking experiments)
Experiment implementation and crowdsourcing platforms	Programming basics in E-Prime software and Gorilla platform to implement experiments
EEG and fNIRS basics	The nature of EEG and fNIRS signals; examples of language-related ERP components (e.g., N400 and P600) and fNIRS activations

fNIRS experimental design	Introduce examples of fNIRS studies and explain how fNIRS can be used to answer important questions about language and the mind
fNIRS data recording	Basic recording procedure of typical fNIRS experiments. Students can use the fNIRS machine in our Lab to collect data for classic experiments.

Course components (Teaching modes and Learning activities)

Teaching Modes and Learning Activities	
On-site face-to-face (hybrid or online modes may be available in extreme conditions)	Percentage of time 100%
Lectures	70% (2 hours/week)
Interactive tutorial	30% (0.75 hour/week)
Or Laboratory activities	30% (0.75 hour/week)
Or Discussion of case	30% (0.75 hour/week)
Out-of-classroom	Percentage of time 100%
Self study	66% (2 hours/week)
Project work	17% (0.5 hour/week)
Lab work	17% (0.5 hour/week)

Assessment type, percentage and rubrics

Assessment type	**Description**	**Percentage**
Mid-term and Final Exams	Mid-term and final exams will assess the didactic information presented in the lectures. Mid-term: 10% Final: 15%	25%
Behavioral/EEG/fNIRS experimental report	submit an experimental report on behavioral/EEG/fNIRS recording, data analysis, and visualization. Students need to submit a report describing the experiment rationale, recording steps, analysis pipeline, results, and data visualization.	20%
Research presentation	Students need to present a research paper about a topic that interests them.	15%
Final Research Proposal	Design a logical behavioral/EEG/fNIRS experiment to address a research question in any field of language sciences.	35%
Short Assignments	Short assignments will be administered to promote interactive learning in lectures.	5%

Required and recommended readings

There is no required textbook. This is the list of required and recommended readings, and more required readings will be announced in class. All readings are posted on Blackboard (http://blackboard.cuhk.edu.hk).
* indicate required readings

Week 1

- * Penke, M., & Rosenbach, A. (2007). What counts as evidence in linguistics? An introduction. In M. Penke & A. Rosenbach (eds). *What Counts as Evidence in Linguistics.* John Benjamins Publishing Group: Amsterdam.
- * Goodwin, C.J. (2013). Research in Psychology: Methods and Designs. *Wiley: NJ.* [Chapters 1 and 3]

- Peirce, C. S. (1877). The fixation of belief. *Popular Science Monthly*, 1-15. http://www.peirce.org/writings/p107.html
- Drost, E. A. (2011). Validity and reliability in social science research. *Education Research and Perspective*, 38, 105–123.

Week 2

- * Gibson, E. and Fedorenko, E. (2010) Weak quantitative standards in linguistics research. Trends Cogn. Sci. 14, 233–234
- Gibson, E., Pearlmutter, N., Canseco-Gonzalez, E., & Hickok, G. (1996). Recency preference in the human sentence processing mechanism. Cognition, 59(1), 23-59.

Week 4

- * Abbuhl, R., Gass, S., & Mackey, A. (2013). Experimental research design. Chapter 7, In R. J. Podesva & D. Sharma (eds). Research Methods in Linguistics. *Cambridge University Press: NY*.
- Eckert, P. (2013). Ethics in linguistic research. In R. J. Podesva & D. Sharma (eds). Research Methods in Linguistics. Cambridge University Press: NY.

Week 5-7, 9

- * Kaiser, E. (2013). Experimental paradigms in psycholinguistics. In R. J. Podesva & D. Sharma (eds). Research Methods in Linguistics. *Cambridge University Press: NY*.
- Saffran, J.R., Newport, E.L., & Aslin, R. N. (1996). Word segmentation: the role of distributional cues. *Journal of Memory and Language*. 35, 606-621.
- Spivey, M.J., Grosjean, M., & Knoblich, G. (2005). Continuous attraction toward phonological competitors. *PNAS*. 102, 10393-10398.
- Spivey, M.J. & Marian, V. Cross talk between native and second languages: partial activation of an irrelevant lexicon. *Psych Science*. 10, 281-284.
- * Spapé, M., Verdonschot, R., & Van Steenbergen, H. (2020). The E-Primer: An introduction to creating psychological experiments in E-Prime. Leiden University Press.
- P.C. Gomez (2013). Statistical Methods in Language and Linguistic Research. *Equinox: CT*. [Chapters 1-3]

Week 10-13

- Gazzaniga et al. (2002). The Methods of Cognitive Neuroscience (Chapter 4). *Cognitive Neuroscience: The Biology of the Mind.*
- * Kemmerer D. 2014. Cognitive Neuroscience of Language: Psychology Press. (PART I)
- * Kutas M. and Federmeier K.D. (2000). Electrophysiology reveals semantic memory use in language comprehension. *Trends in Cognitive Sciences, 4*, 463-470.
- * Embick, D. & Poeppel, D. (2015). Towards a computational(list) neurobiology of language: correlational, integrated and explanatory neurolinguistics. *Language, Cognition and Neuroscience*, 30, 357-366.
- * Luck, S. J. (2014). An introduction to the event-related potential technique. MIT Press.
- Steven J. Luck. Applied Event-Related Potential Data Analysis, 2022, LibreTexts: https://socialsci.libretexts.org/Bookshelves/Psychology/Book%3A_Applied_Event-Related_Potential_Data_Analysis_(Luck)
- Luck, S. J., & Kappenman, E. S. (Eds.). (2011). The Oxford handbook of event-related potential components. Oxford university press.
- Verma, Siddhartha. Matlab for Newbies: The Bare Essentials. (This book will guide your first steps in programming in Matlab) http://fau.digital.flvc.org/islandora/object/fau%3A41899
- Sizemore, J., & Mueller, J. P. (2014). MATLAB for Dummies. John Wiley & Sons.

- Install Matlab with CUHK license following this guideline: https://www.itsc.cuhk.edu.hk/tc/all-it/procurement-support/campus-wide-software/matlab-and-simulink/

Week 14

- Tak, S., Ye, J.C., 2014. Statistical analysis of fNIRS data: A comprehensive review. Neuroimage 85, 72-91.
- Almajidy, R. K., Mankodiya, K., Abtahi, M., & Hofmann, U. G. (2019). A newcomer's guide to functional near infrared spectroscopy experiments. IEEE Reviews in Biomedical Engineering, 13, 292-308.
- Steinbrink, J., Villringer, A., Kempf, F., Haux, D., Boden, S., & Obrig, H. (2006). Illuminating the BOLD signal: combined fMRI–fNIRS studies. Magnetic resonance imaging, 24(4), 495-505.
- * Czeszumski, A., Eustergerling, S., Lang, A., Menrath, D., Gerstenberger, M., Schuberth, S., ... & König, P. (2020). Hyperscanning: a valid method to study neural inter-brain underpinnings of social interaction. Frontiers in Human Neuroscience, 14, 39.
- * Cui, X., Bryant, D. M., & Reiss, A. L. (2012). NIRS-based hyperscanning reveals increased interpersonal coherence in superior frontal cortex during cooperation. Neuroimage, 59(3), 2430-2437.

Feedback for evaluation:
Students are welcome to give comments and feedback by sending them in written form to the instructor's email address or talking to the instructor.

Grade Descriptors

Grade	Overall Course
A	Demonstration of a thorough understanding of experimental designs and methods in experimental linguistics with virtually no weakness, including the ability to 1) describe behavioral and neuroimaging methods used in experimental linguistic research, 2) describe the pros and cons of the mainstream approaches, 3) understand the logic of classic behavioral experimental design, 4) understand how to devise and measure appropriate variables, 5) understand the basic principle of EEG/fNIRS signals and the recording procedures, 6) understand basic statistical approaches, 7) write lab reports to describe the methods and results of a behavioral/EEG/fNIRS experiment.
A-	Demonstration of a thorough understanding of experimental designs and methods in experimental linguistics with only minor weaknesses, including the ability to 1) describe behavioral and neuroimaging methods used in experimental linguistic research, 2) describe the pros and cons of the mainstream approaches, 3) understand the logic of classic behavioral experimental design, 4) understand how to devise and measure appropriate variables, 5) understand the basic principle of EEG/fNIRS signals and the recording procedures, 6) understand basic statistical approaches, 7) write lab reports to describe the methods and results of a behavioral/EEG/fNIRS experiment.
B	Demonstration of a thorough understanding of experimental designs and methods in experimental linguistics with weaknesses in no more than one major component of the course. Evidence of a thorough understanding may include the ability to 1) describe behavioral and neuroimaging methods used in experimental linguistic research, 2) describe the pros and cons of the mainstream approaches, 3) understand the logic of classic behavioral experimental design, 4) understand how to devise and measure appropriate variables, 5) understand the basic principle of EEG/fNIRS signals and the recording procedures, 6) understand basic statistical approaches, 7) write lab reports to describe the methods and results of a behavioral/EEG/fNIRS experiment.
C	Demonstration of an understanding of experimental designs and methods in experimental linguistics with a few weaknesses
D	Demonstration of some understanding of experimental designs and methods in experimental

	linguistics with weaknesses in serval major components.
F	Demonstration of a minimal understanding of experimental designs and methods in experimental linguistics with significant weaknesses in many components.

Course Schedule

Class/ week	Date	Topics and requirements
Week 1	Jan 11	Overview of paradigms and methods in language sciences (e.g., experimental methods and core concepts: hypothesis testing, prediction, assumption, falsifiability, validity, reliability, deductive and inductive reasoning) (Lab tour @ LKK G36, Department of Linguistics and Modern Languages)
Week 2	Jan 18	Conventional offline approaches: grammaticality judgment and experimental alternatives (Lab tour in eye-tracking and fNIRS labs @ HYS and WFY, Brain and Mind Institute)
Week 3	Jan 25	Online processing approaches: reaction time measures, self-paced reading, mouse tracking, and eye tracking (Lab: E-Prime, the basic functions, the logic of constructing an E-Prime program, and helping students install E-Prime in their laptops)
Week 4	Feb 01	Introduction to research design (within- vs. between-subject design, cross-sectional vs. longitudinal design, etc.) (Lab: E-Prime demo for constructing a semantic priming experiment)
Week 5	Feb 08	Language learning studies and Randomized Controlled Trials (RCT) (Lab: introducing Gorilla, user interface, and programming logic)
Week 6	Feb 15	Language and Cognition I (Overview of language and cognition; introduce the relationships between perception, attention, memory, and language) (Lab: constructing a semantic priming experiment with Gorilla; part I)
Week 7	Feb 22	Language and Cognition II (Cognitive processes of language) (Lab: constructing a semantic priming experiment with Gorilla; part II)
Week 8	Feb 29	Overview of Neurolinguistic approaches and paradigms (Mid-Term Exam, 1 hour)
Week 9	March 07	Reading week
Week 10	March 14	EEG basics and ERP components (Lab: EEG data preprocessing and ERP analysis with N400 experiment dataset)
Week 11	March 21	fNIRS basic and signals (Lab: fNIRS experiment design and recording)
Week 12	March 28	fNIRS experiments in the lab

Week 13	April 04	*Holiday*
Week 14	April 11	fNIRS hyperscanning and classroom-based language teaching and learning (Lab: fNIRS hyperscanning demo)
Week 15	April 18	Final Exam

Contact details for teacher(s) or TA(s)

Professor/Lecturer/Instructor:	Prof.
Name:	FENG Gangyi
Office Location:	G09 KKB or 401 4/F HYS
Office Hours:	Wed 15:30-17:00 or by appt English, Cantonese (native), Mandarin (native)
Telephone:	3943-3190
Email:	g.feng@cuhk.edu.hk
Teaching Venue:	Lee Shau Kee Building (LSK) 302
Class/Tutorial Time:	Thursday 14:30-16:15 (Lecture), 16:30 – 17:15 (Tutorial)
Website:	https://www.researchgate.net/profile/Gangyi-Feng
Other information:	Google Scholar: Gangyi Feng (冯刚毅)

Teaching Assistant/Tutor:	To be determined
Name:	
Office Location:	
Telephone:	
Email:	
Teaching Venue:	
Other information:	

Details of course website

All announcements of the course will be posted on Blackboard (https://blackboard.cuhk.edu.hk).

Academic honesty and plagiarism

Attention is drawn to University policy and regulations on honesty in academic work, and to the disciplinary guidelines and procedures applicable to breaches of such policy and regulations. Details may be found at http://www.cuhk.edu.hk/policy/academichonesty/.

With each assignment, students will be required to submit a signed declaration that they are aware of these policies, regulations, guidelines and procedures.

- In the case of group projects, all members of the group should be asked to sign the declaration, each of whom is responsible and liable to disciplinary actions, irrespective of whether he/she has signed the declaration and whether he/she has contributed, directly or indirectly, to the problematic

contents.

- For assignments in the form of a computer-generated document that is principally text-based and submitted via VeriGuide, the statement, in the form of a receipt, will be issued by the system upon students' uploading of the soft copy of the assignment.
- Students are fully aware that their work may be investigated by AI content detection software to determine originality.
- Students are fully aware of the AI approach(es) adopted in the course. In the case where some AI tools are allowed, students have made proper acknowledgment and citations as suggested by the course teacher.

Assignments without a properly signed declaration will not be graded by teachers.

Only the final version of the assignment should be submitted via VeriGuide.

The submission of a piece of work, or a part of a piece of work, for more than one purpose (e.g. to satisfy the requirements in two different courses) without declaration to this effect shall be regarded as having committed undeclared multiple submissions. It is common and acceptable to reuse a turn of phrase or a sentence or two from one's own work; but wholesale reuse is problematic. In any case, agreement from the course teacher(s) concerned should be obtained prior to the submission of the piece of work.

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Use of generative AI tools

The use of AI tools is allowed with explicit acknowledgment and proper citation for assignments.
The use of AI tools is prohibited for mid-term and final exams.