

語言的腦科學基礎

The Neuroscience of Language

Time: Wednesday 3:30-6:20 pm

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Office hour: by appointment

Course description

在日常生活中，語言無所不在，如同正在閱讀這份課程綱要的你，也正在使用語言。不過，你知道你的大腦執行了哪些任務，讓你能理解這份文件裡的每個字、每個句子的意思的嗎？

雖然我們把語言這項「技能」視作理所當然，但是語言本身是高層次的認知功能，大腦常常是在我們沒察覺地情況下，進行了很多精密的工作，才使我們達到溝通交流的目的。雖然我們知道是大腦在支持語言的運作，但是日常生活中仍然有許多似是而非的言論與迷思，例如「她腦波很弱，很容易就被說服了」、「那個腦傷的病人總是在胡言亂語，他應該發瘋了」、「六招開發大腦強化語言學習」等等。然而，腦波真的有強弱之分嗎？腦傷病人可以提供語言與大腦研究什麼樣的視野？我們真的能透過開發大腦來加強語言學習嗎？本課程將以深入淺出的方式，除了描述語言的生理基礎、探討大腦在理解、產出語言所經歷的步驟，以及討論語言學習的議題。我們將引用最新的腦科學實證，以輕鬆有趣的討論來破解有關語言與大腦心智運作的迷思。

We use language to read and communicate. Now you are reading the descriptions of this course, but do you know the processes that your brain is being through to decode the meaning of each word and interpret the meaning of each sentence?

This course introduces basic concepts of the brain and language. The topics of this course include, but are not limited to, the neural basis of language, the processes to comprehend/produce a sentence, and language acquisition. Since it has been taken for granted that we are empowered with language “skills,” we might not be aware that the brain has to go through sophisticated processes to achieve the communicative goal. In addition, there is some common misunderstanding between language and the brain. For example, we might see advertisement like “boost language learning by training your brain” on the internet. TV shows and movies might have conveyed the idea that patients of language disorders could lose their mind. In this course, we will evaluate these myths with empirical research. It is hoped that after taking this course, students can be informed and critical in language science research.

Materials:

Pinker, S. (1994/2007). *The Language Instinct*. New York, NY: Harper Perennial Modern Classics.

中文譯本: Pinker, S. (2007). *語言本能：探索人類語言進化的奧秘*。(洪蘭譯)，台北:商業周刊。

Tentative Schedule

單元一: 語言與大腦

Unit 1: Language and the Brain

第 1 週: 課程簡介

Week 1: Course overview

第 2 週: 語言的神經基礎

如何使用科學，特別是腦造影的方法來研究語言？大腦裡真的有所謂的「語言區」嗎？失語症病人的案例可以怎麼告訴我們語言與大腦的關係？我們的左腦和右腦是各司其職嗎？左腦和右腦之間是如何溝通？學者又是用什麼方法來研究這樣的問題呢？

Week2: Neural basis of language

How can we use scientific methods, especially neuroimaging techniques, to study language? Do we have language areas in the brain? What can we learn about the relation between language and the brain from aphasia patients? Are the left hemisphere and the right hemisphere involved in different tasks? How do the two hemispheres communicate with each other? What are the methods to probe this question?

- 參考文獻 Reference: Benton, A. & Anderson, S. W. (1998). Aphasia: historical perspectives. In Sarno, M. T. (Ed.). *Acquired Aphasia* (pp. 1-24). San Diego: Academic Press.
參考文獻 Reference: Gazzaniga, M. S. (1967). The split brain in man. *Scientific American*, 217(2), 24-29.

單元二: 大腦處理語言是怎樣的過程?

Unit 2: How does the brain process language?

第 3 週: 語音辨識

我們如何區辨不同的語音？語音辨識和說話發音有什麼共同點？

Week3: Speech perception

How do we distinguish speech sounds from acoustic signals? Are there anything in common between speech perception and speech production?

第 4 週: 影片欣賞

Week 4: Film watching

第 5 週: 字詞辨識

我們是如何辨識詞彙的？是否我們在心裡存有一本字典呢？詞彙辨識經歷了哪些階段呢？大腦裡面有專屬辨識詞彙的腦區嗎？

Week 5: Word recognition

How do we recognize words? Do we have a dictionary stored in our mind? What are the stages you go through when you recognize a word? Is there an area in the brain that is dedicated to word recognition?

- 參考文獻 Reference: Words, words, words. In Pinker, S. (1994/2007). *The Language Instinct*. (pp.119-152)

第 6 週: 詞彙表徵與語意網路

[公布作業一、於一週後繳交 Assignment 1 will be posted, due in a week]

大腦中是否有對詞性(動詞 vs. 名詞)比較敏感的腦區? 當提取多義詞的時候 (如英文的 Park 有公園與停車兩種意思) , 是否兩個語意都會同時活化呢?

Week 6: Lexical representations and semantic network

Are some parts of the brain sensitive to the distinction between nouns and verbs? When a word is polysemous (e.g. “park” in English can be a public area or leaving a car), are all the meanings activated initially when you retrieve the word?

- 參考文獻 Reference: Lee, C. L., & Federmeier, K. D. (2012). Ambiguity's aftermath: How age differences in resolving lexical ambiguity affect subsequent comprehension. *Neuropsychologia*, 50(5), 869-879.

第 7 週: 語句理解

在理解句子的時候, 我們只是被動地把句子閱讀完、聽人家把話說完嗎? 還是在不知不覺中, 我們已經在猜測書本、對方下個字會出現什麼呢? 大腦是否隨時隨地都在做預測呢?

Week 7: Sentence comprehension

When comprehending a sentence, do we passively wait for the linguistic inputs to arrive, or do we actively make predictions of the upcoming word? Does the brain make predictions all the time?

- 參考文獻 Reference: Van Petten, C., & Luka, B. J. (2012). Prediction during language comprehension: Benefits, costs, and ERP components. *International Journal of Psychophysiology*, 83(2), 176-190. (Read: 176-177)

第 8 週: 春假

Week 8: Spring break

第 9 週: 語言產出

[公布作業二、於一週後繳交 Assignment 2 will be posted, due in a week]

我們所說的話都是完美、沒有錯誤的嗎? 口誤在口語表達中出現頻率高嗎? 仔細豎起耳朵觀察不同的口誤, 什麼類型的口誤最容易發生? 什麼類型的口誤幾乎不曾出現? 這中間的規律告訴我們什麼?

Week 9: Language production

Is our speech always perfect and error-free? Is it common to make speech errors when we talk? Pay attention to speech errors carefully. What kinds of speech errors are the most common? What kinds of speech errors are less likely to occur? What can we learn from the patterns discovered from speech errors?

- 參考文獻 Reference: Fromkin, V. A. (1971). The non-anomalous nature of anomalous utterances. *Language*, 27-52.

單元三: 語言發展與雙語研究

Unit 3: Language development and bilingualism

第 10 週: 語言習得 [期末報告分組 Assign final project groups]

學習語言有黃金關鍵期嗎? 有可能只看電視或是 Youtuber 就把外語學好嗎?

Week 10: Language acquisition

Is there a critical period to learn a language? Can we master our language skills simply by watching TV or Youtube materials?

- 參考文獻 Reference: Baby born talking—Describes Heaven. In Pinker, S. (1994/2007). *The Language Instinct*. (pp.265-301)

第 11 週: 第二語言/外語習得

[繳交期末小組報告題目 Submit final group project topics]

學習新的語言會改變大腦的結構? 哪些因素會影響外語學習的成就? 為什麼語言的有些層面(如文法、發音)會特別難學? 跟母語人士說話的時候, 文法不好怎麼辦? 我們講母語有腔調嗎? 為什麼我們講外語很容易有腔調?

Week 11: Second/ Foreign language acquisition

How does learning a new language affect the biological structure of the brain? What are the factors that could impact the ultimate achievement of a second language? Why some aspects of language (such as grammar, pronunciation) are especially challenging for second language learners? Should we worry about grammar when communicating with a native speaker? Do we have an accent as we speak our native language? Why is it the case that we tend to speak a second/foreign language with an accent?

- 參考文獻 Reference: Abutalebi, J. (2008). Neural aspects of second language representation and language control. *Acta psychologica*, 128(3), 466-478.
參考文獻 Reference: Lippi-Green, R. (1997). The myth of non-accent. *English with an accent: Language, ideology, and discrimination in the United States*, 41-52.

第 12 週: 語碼轉換與雙語優勢

語碼轉換(或套用新聞流行語, 晶晶體)是怎麼回事? 我們的大腦是怎麼反應的? 能熟練地使用外語可以延緩阿茲海默症?

Week 12: Code-switching and bilingual advantage

What is code-switching? How does our brain respond to code-switching? Can mastering a foreign language delay the onset of Alzheimer disease?

- 參考文獻 Reference: Bialystok, E., & Craik, F. I. (2010). Cognitive and linguistic processing in the bilingual mind. *Current directions in psychological science*, 19(1), 19-23.

第 13 週: 語言相對論

我們所說的語言會影響我們怎麼看世界嗎? 法文的月亮是陰性的、德文的月亮是陽性的、所以和德國人相比、是否在法國人的眼中、月亮是比較女性化的意象呢?

Week 13: Linguistic relativity

Does the language we speak affect the way we perceive the world? For example, in French, “moon” is a feminine noun while in German moon is a masculine one. Is the moon more feminine in French speakers’ mind than that in German speakers’ mind?

- 參考文獻 Reference: *Mentalese*. In Pinker, S. (1994/2007). *The Language Instinct*. (pp.44-73)

第 14 週: 專題演講 (題目待定)

Week14: Guest speaker. Topic TBD.

第 15-16 週: 小組報告

Weeks 15-16: Group presentations

Evaluations:

- 出席 (課堂點名) Attendance: 10%
- 作業 Assignments: 20%

學期中會有 2 個課後小作業，以中文或英文書寫皆可。學生於指定時間截止前上傳至課程平台。除非緊急狀況(須繳交正式證明文件)，一律不收遲交作業。

There will be 2 assignments throughout this semester. The assignments can be written in English or Mandarin, and should be uploaded to eclass before the due date. Except for serious and documented emergencies, late assignments will not be accepted.

- 課堂參與 Participation: 30%

課堂上的討論與活動 Discussions and activities in class: 10%

課後(eeclass 討論版) 提問 Raise follow-up questions on eeclass after class: 20%

同學任選五週，於當週課後在課程討論版上提出延伸思考的問題 (中英文皆可)。每週 eeclass 討論版開放時間: 週三課後至下週一晚間 11:00 前，逾期不再開放。

註: 延伸思考的問題並非針對課堂上不懂的概念來提問 (同學平時有不懂的就應該立即請教老師或助教)。

Choose 5 topics discussed in class, and raise a follow-up question on the discussion board after class (either in English or Mandarin). Discussion board on eeclass will be

open from Wednesday after class to 11:00 pm of the following Monday. Late submission won't be accepted.

Note that follow-up questions are not clarification questions. If you have anything you don't understand, you should contact the TA or the instructor right away

- 小組口頭報告 Group oral presentation 30%

學生由教師分組進行口頭報告，報告題目可以是上課沒討論到的主題，但必須和「語言與大腦」相關。報告形式為英文簡報，加上中文或英文進行問答的時間。評量方式將由教師與修課同學共同評分。

Students will be divided into groups to research a topic related to “language and the brain”, and do a 35-minute PowerPoint presentation (in English) followed by a 10-minute Q & A session (can be either in English or Mandarin). This topic can be something that we have not covered in class. The presentation will be evaluated both by the instructor and the class.

- 期末心得報告 Final report and reflection 10%

針對本學期上課的收穫撰寫心得報告，內容約 500-600 字。報告內容以中文或英文書寫皆可。

Write a reflection based on what you have learned throughout this semester. The content should be 500-600 words long. It can be written either in English or Mandarin.