The Hong Kong Polytechnic University

Subject Description Form

Subject Code	CBS1A13
Subject Title	The Talking Brain
Credit Value	3
Level	1
Pre-requisite / Co-requisite/ Exclusion	None
Objectives	Language is a unique human trait. It engages people in thinking, talking, comprehension and interaction, and serves as a basic building block for human cognition and human social relations. One of the best ways to understand language is from the perspective of the brain. What neurobiological factors make human language possible? Which part of the brain supports talking and comprehension? How does language develop in a child's brain? How does aging and brain injury affect these abilities? This introductory subject provides a general overview of language and the brain. It will help students to develop an understanding of diverse topics, including the brain bases of language production, language comprehension, language development, and language disorders. In particular, an emphasis will be placed on the Chinese language such as Cantonese and Putonghua, to reveal how learning Chinese fundamentally shapes the brain. This subject is suitable for anyone who is interested in this topic and does not require prior knowledge.
Intended Learning Outcomes *(Note 1)*	Upon completion of the subject, students will be able to: a. Be equipped with state-of-the-art knowledge of language areas in the brain that support language production and comprehension; b. Be equipped with state-of-the-art knowledge of language disorders and how they are reflected by abnormal brain activities and brain structures; c. Demonstrate a basic understanding of state-of-the-art brain imaging techniques; d. Appreciate how learning Chinese transforms the brain; e. Integrate learned knowledge of language and the brain with real-life examples; f. Actively reflect upon their personal language learning and development experience, and to apply the learned knowledge to the understanding of their own experiences (e.g. what is a good time to learn a second language? How does learning Chinese shape the brain? etc.)

	Please explain how the stated learning outcomes relate to the following three essential features of GUR subjects: Literacy, Higher order thinking, and Skills for life-long learning. **Literacy** Literacy skills in English will be improved by (1) extensive reading of journal articles and book chapters in English on the topic of language and the brain; (2) the writing of a comprehensive 1,500 – 2,500 words essay in English based on a self-chosen topic of language and the brain. **Higher order thinking** Higher order thinking will be improved via comprehensive discussions and systematic review of questions regarding language and the brain. The field of language and the brain is relatively new, and many questions are currently under debate, such as how language is processed and organized in the brain. Moreover, many questions are complex with no simple yes-or-no answers. Students will be provided with such questions in small group discussions, and encouraged to think critically about the arguments and counter-arguments. In addition, critical thinking skills will be exercised and enhanced via essay writing, which requires the students to review and summarize state-of-the-art knowledge of a self-chosen topic about a specific aspect of language processing or language disorder in the brain. It will help students to develop higher-order understanding and appreciation of the complexity of language and the human brain. **Life-long learning** Life-long learning will be achieved via active integration of learned knowledge with real-life experience. The topic of language and the brain is closely tied to a wide range of real-life experience, such as language learning, brain development, child education, aging, stroke, health care and so on. Students will be encouraged to reflect upon their own language learning experience, and apply the learned knowledge to the understanding of such experiences (e.g. What is a good time to learn a second language? How does learning Chinese shape the brain?). By weaving real-life experience into the learning process, students will obtain a more meaningful understanding of the subject. Moreover, the knowledge learned in this course may continue to be useful later in life, when the students are going to make decisions on child education when they become parents, or to take care of an elderly parent who suffered from impairment in communication abilities following a stroke, etc.
Subject Synopsis/ Indicative Syllabus *(Note 2)*	**1. <u>Introduction</u>** • Co-evolution of language and the brain • Neurons and brain structure • Neuroimaging techniques **2. <u>Language areas in the brain</u>** • Discovery of the language areas • Localism vs. holism theories • Recent brain models of language processing

	3. <u>Lateralization of language</u> • Functional hemispheric asymmetry • Structural hemispheric asymmetry • Split-brain patients **4. <u>Nature of language: modular or non-modular</u>** • Modular vs. non-modular theories • Neural organization of language and other cognitive abilities • Language and music **5. <u>The Chinese brain</u>** • Whorf-Sapir hypothesis • How learning Chinese tones shapes the brain • How learning the Chinese logographic writing system shapes the brain **6. <u>Language and memory</u>** • Short-term memory and long-term memory • Declarative memory and procedural memory **7. <u>Language and mirror neurons</u>** • The mirror system hypothesis • Imitation and mirror neurons • Speech and action-oriented perception **8. <u>Language disorders</u>** • Broca's aphasia • Wernicke's aphasia • Specific language disorder • Dyslexia
Teaching/Learning Methodology *(Note 3)*	This subject will be delivered in lectures complemented by tutorials and a visit to the EEG lab. 1. State-of-the-art theories and knowledge of language and the brain will be taught in the lectures. 2. Tutorials are student-centered and more interactive in nature, which are comprised of mini-games, video watching, group discussion and group oral presentation, in order to encourage active learning and critical thinking. Mini-games will be designed to help the students learn interactively and in a fun way. The group presentation is comprised of video watching, group discussion and oral presentation. A list of videos covering different topics of language and the brain will be provided to the students. Video watching will boost the students' interest and help them to attach real meaning to the topic. Students will be asked to select one topic, and summarize the content and related knowledge in a concise and creative way in a group oral presentation. Students will be encouraged to reflect upon and integrate their own experience during the discussions and presentations.

3. A visit to our EEG lab at CBS (QR602) will be arranged for the students during one of the tutorials. From this visit, students will gain first-hand experience of observing the setup of an EEG study, and real-time brain waves as a subject performs a language task.

Assessment Methods in Alignment with Intended Learning Outcomes

(Note 4)

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
		a	b	c	d	e	f
1. Lab visit	5%	√	√	√			
2. Test	35%	√	√	√	√		
3. Group oral presentation	20%	√	√	√	√	√	√
4. Essay	40%	√	√	√	√	√	√
Total	100 %						

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

1. The EEG lab visit offers the students an opportunity of experiential learning by observing the real-time brain waves of a human subject with their own eyes. This allows the students to gain first-hand experience with state-of-the-art brain imaging techniques, and to attach some concrete meaning to the knowledge about the brain that they have learned in the lectures.
2. The test is to examine the students' understanding of the subject topic covered in the whole course. This test not only assesses the students' understanding of basic concepts and theories, but also evaluates the students' higher-order thinking and analysis skills and generalization ability via short questions. 10% of the test items will be based exclusively on the reading of the textbook (page 57-266), in order to fulfill the English reading requirement (see required reading below for details).
3. A list of videos covering different aspects of language processes in the brain will be provided for the group oral presentation. Students will form small groups (3-4 persons per group), and each group will select one topic and collaboratively work on the oral presentation by (1) watching the video and studying the topic comprehensively, (2) critically thinking about different views about the topic, (3) reflecting upon their own experience, and (4) organizing the found materials and information in a clear and creative way. Each group will then report the chosen topic in a group oral presentation. This task will assess the learned knowledge, higher-order thinking and analysis skills, and active integration of real-life experience.
4. The students will be asked to choose a topic on language and the brain, and write a 1,500 – 2,500 words essay in English individually. This essay can be an extension of the group oral presentation, or a totally new topic. If an extension, the students are required to work individually on the essay, and dig deeper into the topic of the group

	presentation. The essay requires a comprehensive summary of the relevant literature, critical thinking and in-depth analysis about a specific aspect of language processing in the brain. Students will be asked to integrate real-life experience in a sub-section of the essay (i.e. discussion part). This task will assess the learned knowledge, higher-order thinking and analysis skills, and active integration of real-life experience. 10% of the grade on the essay will be contributed by the ELC (evaluation of English writing). The remaining 30% of the grade will be evaluated by the instructor on the content of the essay. Students must obtain a D or above on the essay in order to pass the subject.	
Student Study Effort Expected	Class contact:	
	▪ Lectures	26 Hrs.
	▪ Tutorials (including lab visit)	13 Hr.
	Other student study effort:	
	▪ Reading	20 Hrs.
	▪ Quizzes/final test	20 Hrs.
	▪ Group oral presentation	15 Hrs.
	▪ Writing essay	20 Hrs.
	Total student study effort	114 Hrs.
Reading List and References	**Required reading** (to fulfill "English reading" designation) Stemmer, B., & Whitaker, H. A. (2008). *Handbook of the Neuroscience of Language*. London; Burlington, MA: Academic/Elsevier. Pages 57-266. **Recommended readings:** 王士元. (2011). 语言、演化与大脑. 北京：商务印书馆. Ingram, J. C. L. (2007). *Neurolinguistics: An Introduction to Spoken Language Processing and its Disorders*. Cambridge: Cambridge University Press. Faust, M. (2012). *The Handbook of the Neuropsychology of Language*. Chichester: Wiley-Blackwell. Hickok, G., & Poeppel, D., (2007). The cortical organization of speech processing. *Nature Neuroscience, 8*, 393–402. Saffran, J. R., Aslin, R. N., & Newport, E. L. (1996). Statistical learning by 8-Month-Old infants. *Science, 274*(5294), 1926–1928. Geschwind, N., & Levitsky, W. (1968). Human brain: Left-right asymmetries in temporal speech region. *Science, 161*(3837), 186–187. Rizzolatti, G., & Craighero, L. (2004). The mirror-neuron system. *Annual Review of Neuroscience, 27*(1), 169–192. Indefrey, P., & Levelt, W. J. M. (2004). The spatial and temporal signatures of word production components. *Cognition, 92*(1–2), 101–144.	

	Liberman, A. M., & Mattingly, I. G. (1985). The motor theory of speech perception revised. *Cognition, 21*(1), 1–36. Kean, M.-L. (1977). The linguistic interpretation of aphasic syndromes: Agrammatism in Broca's aphasia, an example. *Cognition, 5*(1), 9–46. Vargha-Khadem, F., Watkins, K., Alcock, K., Fletcher, P., & Passingham, R. (1995). Praxic and nonverbal cognitive deficits in a large family with a genetically transmitted speech and language disorder. *Proceedings of the National Academy of Sciences of the United States of America, 92*(3), 930–933. Ullman, M. T., & Pierpont, E. I. (2005). Specific Language Impairment is not Specific to Language: the Procedural Deficit Hypothesis. *Cortex, 41*(3), 399–433. Pugh, K. R., Mencl, W. E., Jenner, A. R., Katz, L., Frost, S. J., Lee, J. R., Shaywitz, S. E., Shaywitz, B. A. (2000). Functional neuroimaging studies of reading and reading disability (developmental dyslexia). *Mental Retardation and Developmental Disabilities Research Reviews, 6*(3), 207–213. Peng G., & Zhang, C. (2015). Tone perception. In Wang, W. S-Y., and Sun, C. (Eds.), *Oxford Handbook of Chinese Linguistics*, pp. 516-530. Oxford University Press. Gu, F., Zhang, C., Hu, A., and Zhao, G. (2013). Left hemisphere lateralization for lexical and acoustic pitch processing in Cantonese speakers as revealed by mismatch negativity. *NeuroImage, 83*, 637-645. Wang, William S-Y. 2013. Language learning and the brain: An evolutionary perspective. In Breaking Down the Barriers: Interdisciplinary Studies in Chinese Linguistics and Beyond, *Language and Linguistics* Monograph Series 50. Eds. by Cao Guangshun, Hilary Chappell, Redouane Djamouri and Thekla Wiebusch, 21-48. Taipei: Institute of Linguistics, Academia Sinica. 王士元. 2013. 語言演化的三個尺度. 科學中國人 1: 16-20. 曾志朗. 智慧从何而来？科学人. 2014 年第 147 期 5 月号. 曾志朗. 语音转录半世纪. 科学人. 2014 年第 147 期 5 月号.

Note 1: Intended Learning Outcomes

Intended learning outcomes should state what students should be able to do or attain upon completion of the subject. Subject outcomes are expected to contribute to the attainment of the overall programme outcomes.

Note 2: Subject Synopsis/ Indicative Syllabus

The syllabus should adequately address the intended learning outcomes. At the same time over-crowding of the syllabus should be avoided.

Note 3: Teaching/Learning Methodology

This section should include a brief description of the teaching and learning methods to be employed to facilitate learning, and a justification of how the methods are aligned with the intended learning outcomes of the subject.

Note 4: Assessment Method

This section should include the assessment method(s) to be used and its relative weighting, and indicate which of the subject intended learning outcomes that each method purports to assess. It should also provide a brief explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes.