2013第六屆陽明大學神經科學暑期研習

認知神經科學簡介

~以動作抑制與文字處理為例~

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認知神經科學 (cognitive neuroscience)
= 探索人腦功能的跨領域整合研究

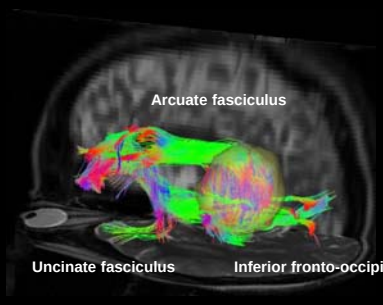
- 神經生物學 (neurobiology)
- 臨床神經與精神醫學 (psychiatry & neurology)
- 電腦資訊科學 (computer science)
- 物理學 (physics)
- 語言學 (linguistics)
- 哲學 (philosophy)
- 數學 (mathematics)

The term 'cognitive neuroscience' was coined by George Miller and Michael Gazzaniga toward the end of the 1970s.

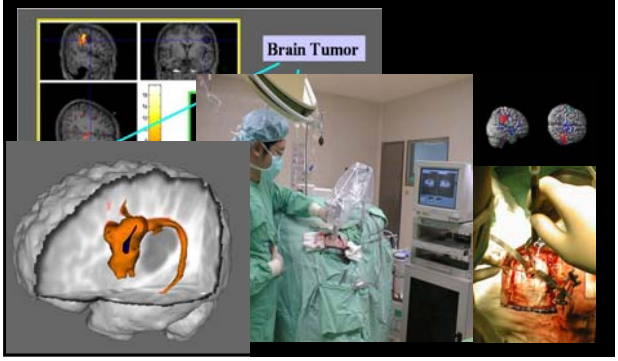
每個腦區都有其獨特的功能？

Paul Broca (1824-1880)

腦瘤的影響 *(1/2)*



腦瘤的影響 (2/2)



現代若干腦造影工具

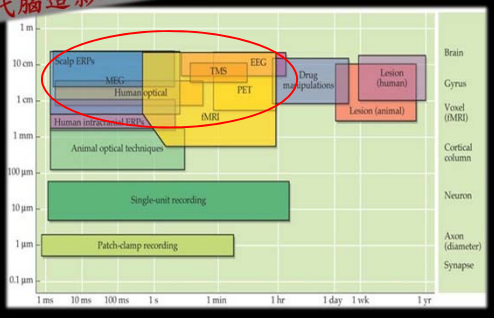

TMS


Current MEG


ERP

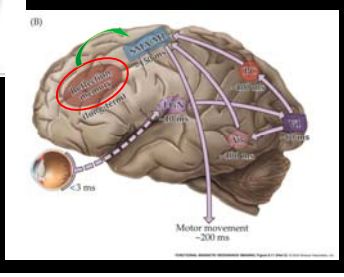

Current MRI

現代腦造影工具的特色

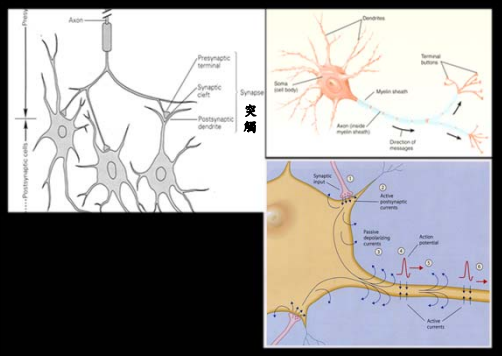


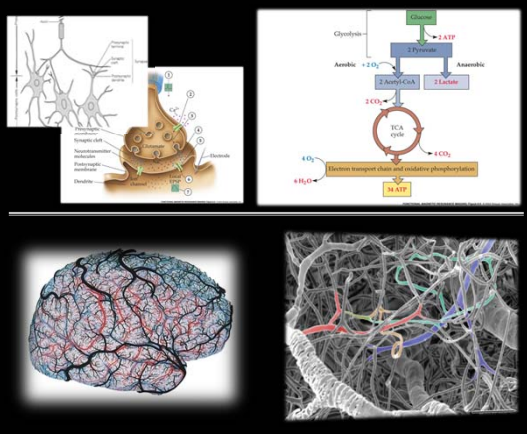
如何*啟動*和*觀察*腦神經系統運作?

- *外在* 刺激所啟動, 例如視覺
- *內在* 運作所啟動, 例如記憶



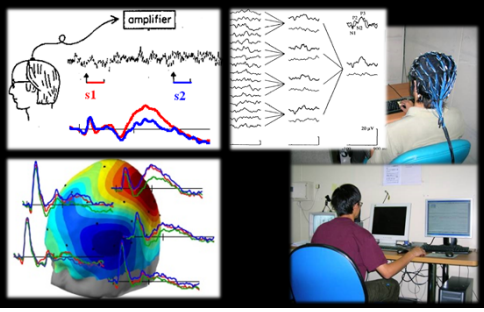
大腦神經元的訊息傳遞與溝通



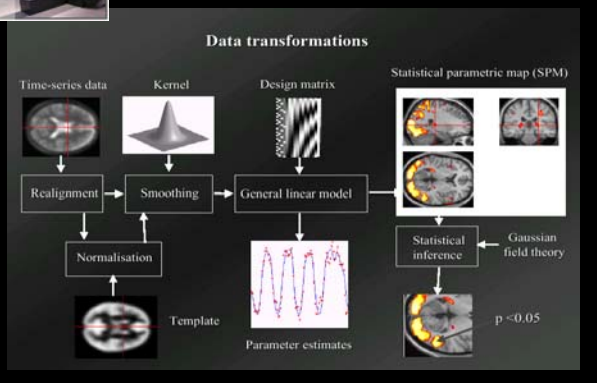


事件誘發電位
Event-Related Potentials *(ERPs)*

- ERPs are extracted from epochs of EEG associated with stimuli of the same category, and reflect the neural processing of experimental stimuli.



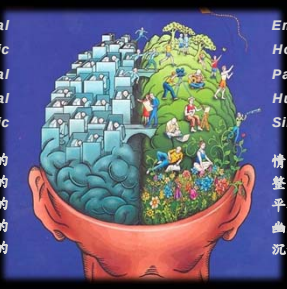
功能性磁振造影
functional magnetic resonance imaging *(fMRI)*



常聽說左腦… 右腦…

Rational
Analytic
Sequential
Logical
Linguistic

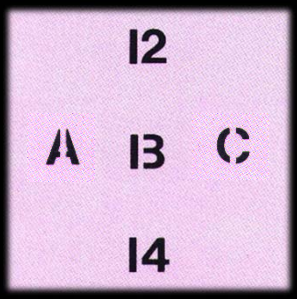
推理的
解析的
序列的
邏輯的
語言的



Emotional
Holistic
Parallel
Humorous
Silent

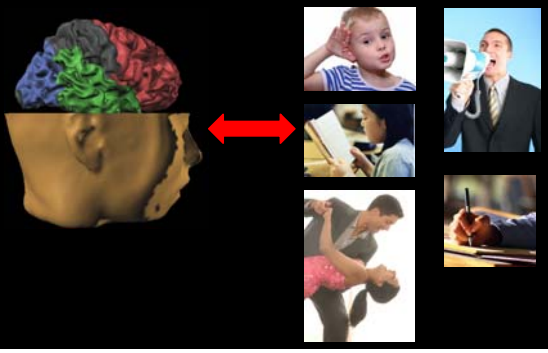
情緒的
整體的
平行的
幽默的
沉靜的

大腦對外界刺激的詮釋



主觀？
客觀？

什麼是認知神經科學?



我們有哪些大腦認知功能/行為？

語言、閱讀、學習、記憶、注意力、視覺認知、物體辨識、動作控制、情緒、同理心 ……

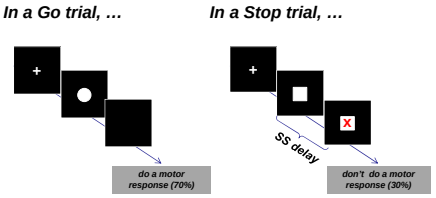
意志力、計畫、決策、問題解決、道德判斷、人際互動 ……

範例研究之一:

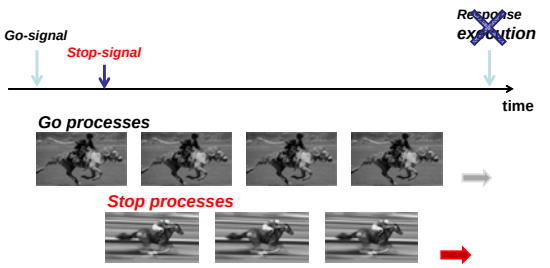
反映動作抑制的神經機制探討

Stop-Signal Action Control Paradigm

Subjects are given a primary task to perform and, on occasion, a stop signal is presented that tells them not to respond on that trial.



Logan & Cowan, 1984



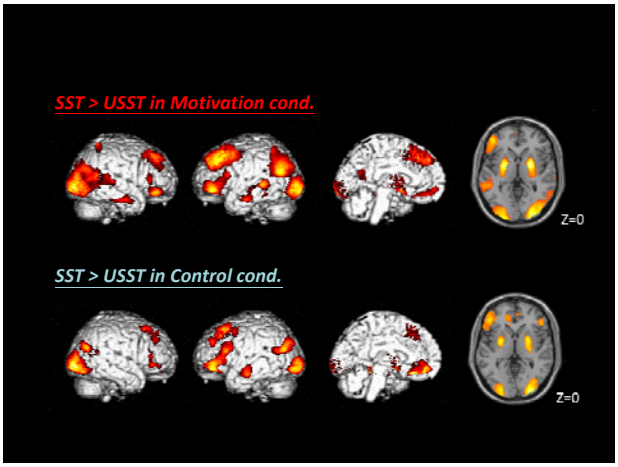
Horse racing model

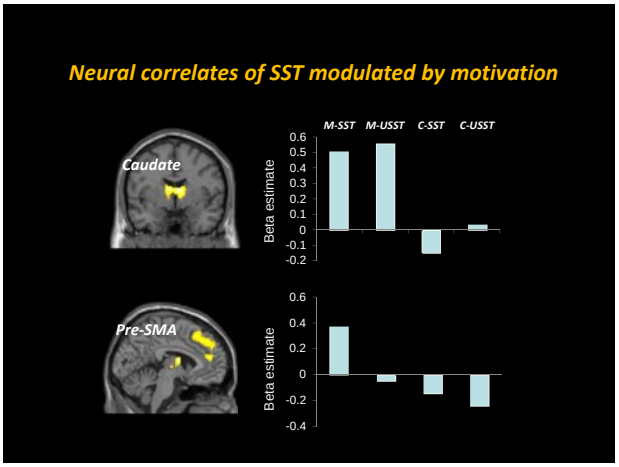
- The response is made or withheld, depending on which horse wins the race.
- Activation and inhibition of an action can operate independently.

Logan, 1994; Boucher et al., 2007

Would the stopping system be influenced by motivation of the participants ?

- 18 participants
- 30% of the trials involved a stop signal and adjusted SSD dynamically
- Procedure:
  - Participants started with a choice RT task for a baseline RT. Then, the SST was administered in a motivational and a control condition.
  - In the motivational condition, the participants were informed they can get a NT2000 bonus if their RT is shorter than the baseline RT. However, there will be a penalty of NT40 for every stop signal missing.
  - In the control condition, there is no motivation treatment.





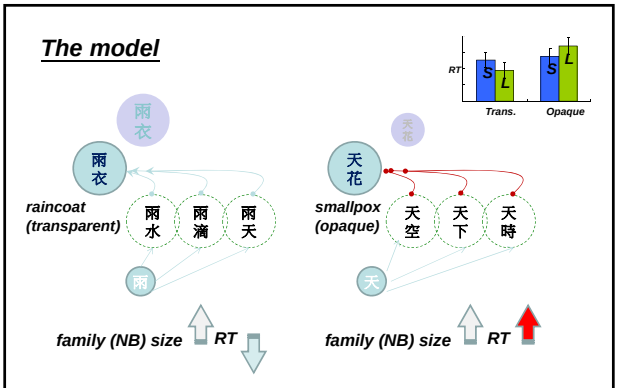
範例研究之二:

反映語言文字特性的認知與神經機制探討

風車	風流
花園	花生
幫手	幫浦
天空	天花
騎士	騎樓

花園、花店、花草、
花束、花茶、花蕊、
花瓣、花蜜、花生…

騎士、騎樓…

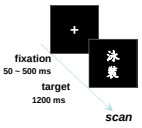


If so, a control mechanism for lexical ***activation*** and ***inhibition*** is expected.

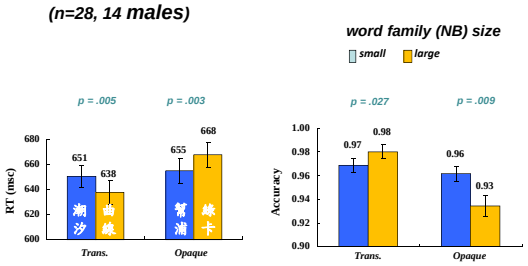
Neural effects of semantic transparency of Chinese reading

- *3T event-related fMRI paradigm*
- *28 college students volunteered for subjects*
- *Lexical decision task, reaction time and accuracy were recoded.*
- *transparency/opaqueness & family (NB) size for variables, word frequency balanced.*

transparent words (n=60)	(S) 愚笨、潮汐、爬山、炊具 …. (L) 閃躲、銅盤、曲線、皮箱 ….
opaque words (n=60)	(S) 蜘蛛、杜鵑、幫浦、摸魚 …. (L) 姑娘、綠卡、天花、把風 ….



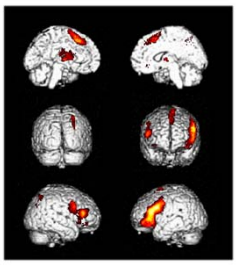
Behavioral data
(n=28, 14 males)

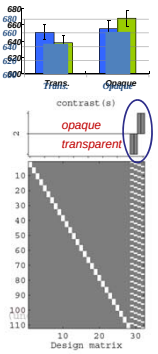


- ***RT transparent < RT opaque***
- ***Lexical activation and inhibition* was revealed.**

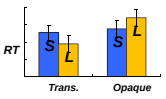
Main effects of semantic transparency

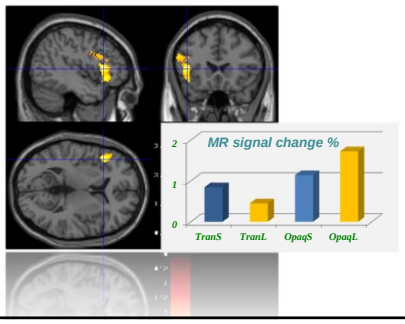
[revealed by the contrast of opaque-vs.-trans]





Interaction of word type and family (NB) size (2/2)





The most interesting part is the finding that there is a brain area to host interaction between different word types and family sizes, suggesting existence of a lexical control mechanism.