WESTERN SYDNEY UNIVERSITY

Working Memory and L2 Speech Processing in Interpreting
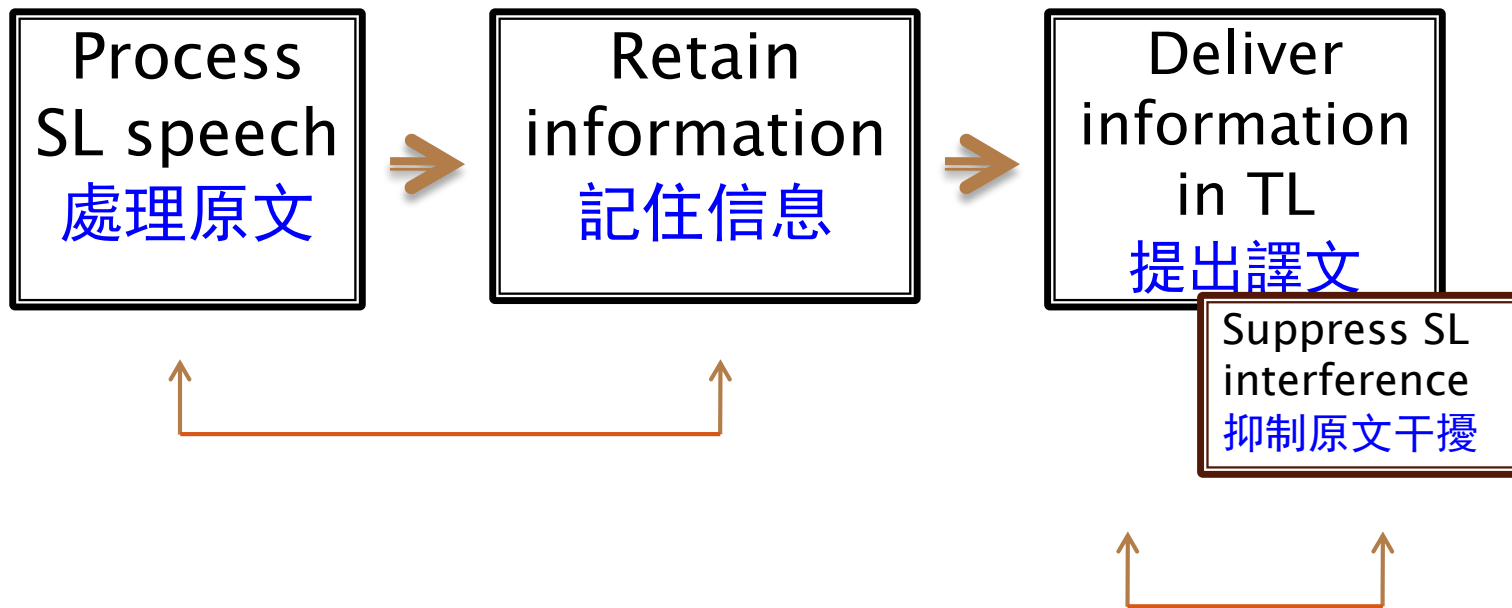# 進行口譯時的工作記憶與第二語言處理

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2019 Lecture Series at STUST, Taiwan

Roadmap 總覽

- What is Working Memory 工作記憶

- Working Memory and L2 工作記憶與第二語言

- WM and interpreting in the weaker language

  工作記憶與口譯時使用較弱語言之間的關係

- WM and Long-term memory 工作記憶與長期記

  憶

WM and Interpreting

Process
SL speech
處理原文

Retain
information
記住信息

Deliver
information
in TL
提出譯文

Suppress SL
interference
抑制原文干擾

What is Working Memory?
什麼是工作記憶

▸ Responsible for short-term maintenance of information
負責信息的短暫儲存

▸ Baddeley's (2000) Multicomponent Model 多元件構成:
  - Phonological loop 音韻迴路
  - Visuo-spatial sketchpad 視覺空間素描板
  - Central executive 中央執行系統
    ➤ Inhibition 抑制
    ➤ Selective attention 選擇性注意力
    ➤ Coordination 信息協調

Baddeley's (2000, p. 421) model of Working Memory

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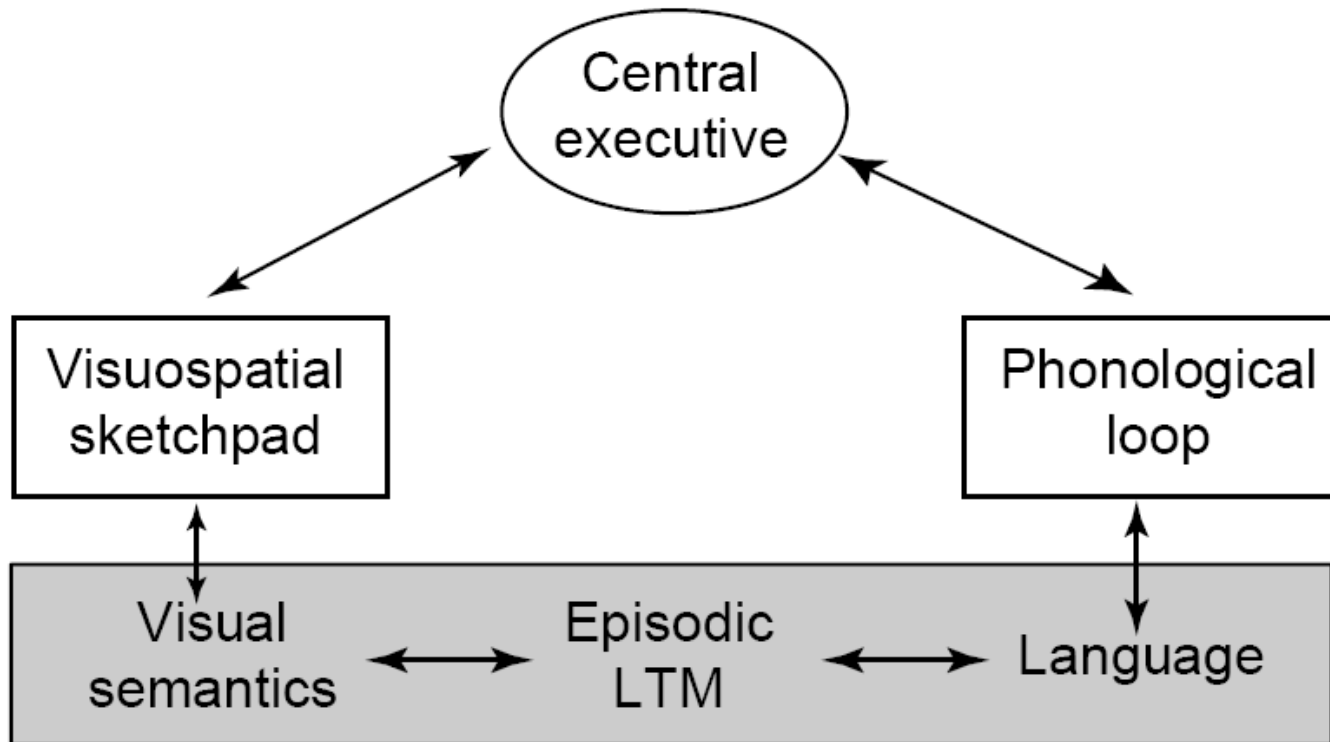
What is stored in Visuo-spatial Sketchpad?

- Visuo-spatial Sketchpad 視覺空間素描板
  - Visual subsystem (shape, colour, etc.) 視覺子系統
  - Spatial subsystem (location) 空間子系統

u16728783 fotosearch.com

What is stored in the Phonological Loop?

- Phonological Loop (Verbal WM) 音韻迴路
  - Limited storage to hold verbal and acoustic information 儲存聲音信息的有限空間
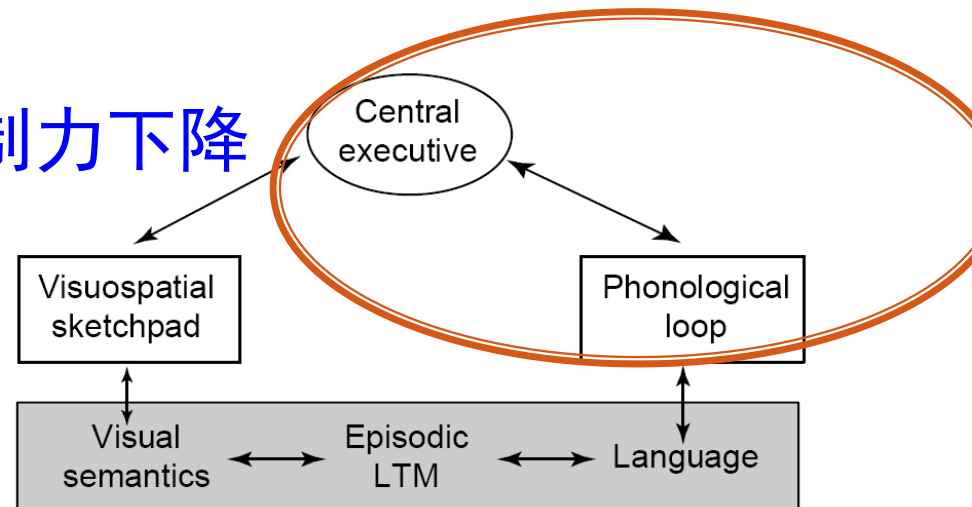 - Articulatory rehearsal 音節複誦

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Central Executive 中央執行系統

- Coordination of information 協調信息

- Selective attention 選擇性注意力

- Inhibition of distractor stimuli 抑制分心物的影響力
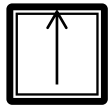
  ◦ Cocktail party effect 雞尾酒派對效果

Verbal WM & Central Executive

- Reduced vWM = Poor attention and weak inhibition.
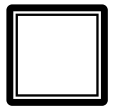- 音韻降低 = 注意力/抑制力下降

Two anti-saccade tasks of different WM demands (Roberts et al. 1994) 眼掃視實驗

Pro-saccade 順向掃視

Anti-saccade 逆向掃視

Verbal Working Memory and Inhibition 語言工作記憶與抑制力

- Performing a concurrent task of adding single-digits 將各位數字相加
  - Task 1: participants made more errors and the reaction time was longer in the anti-saccade (inhibition) task. 逆向掃視錯誤高、反應慢
  - Task 2: **<u>no significant increase</u>** in errors and reaction time in the pro-saccade (no inhibition) task. 順向掃視錯誤、反應無顯著改變

- Reducing working memory capacity weakens central executive functions like inhibition and selective attention. 語言工作記憶下降>抑制力下降

Verbal Working Memory and L2

▸ Articulatory rehearsal.音節複誦
  ◦ Faster = More 速度快 = 信息量多
  ◦ Slower = Less 速度慢 = 信息量少

Verbal Working Memory and L2

▸ vWM holds less information when items are in L2 than in L1. 語言工作記憶能記較多母語信息

▸ vWM capacity correlates with L2 proficiency. 語言工作記憶與外語能力有關係
  ◦ Improvement in L2 -> greater vWM capacity (Adams & Gathercole, 1996) 外語能力提高 >工作記憶能力變強

▸ vWM in L2 expands??? 工作記憶容量變大？？？

Verbal Working Memory capacity for L2 and unfamiliar languages

- French school children learning English L2 for 6 months 法國小學生學英語半年
- Children first tested in English and Arabic. 以英語和阿拉伯語測試工作記憶能力。
- vWM capacity in English L2 increased after 6mth English teaching, but vWM capacity as measured using Arabic words remain the same pre-/post-English teaching (French & O'Brien, 2008). 半年後用英語再測，工作記憶增強；用阿拉伯語測，一樣。
- So when we say vWM capacity for L2 increases… What exactly increases?

Forms and Contents in vWM
信息的形式與信息本身

Verbal Working Memory capacity in L1 工作記憶裝載母語信息

Message Contents	Message Forms

Low L2 proficiency 外語能力弱時

Message Contents	Message Forms

High L2 proficiency 外語能力強時

Message Contents	Message Forms

Increases in L2 proficiency
提高外語能力

- Automatised processing of L2 formal properties (lower-level cognitive processes), leaving more vWM for contents! 對外語信息的形式能自動處理，即可將認知資源用於記憶信息內容。

- Fluent L2 speech means faster articulatory rehearsal, you hold more info in WM. 外語流利 > 復誦速度加快 > 快則能記住更多。

Greater vWM Capaciy -> Central Executive
語言工作記憶能力提高 -> 影響中央執行系統

- Better selective attention 選擇性注意力提高
  - Attend to the target better. 能注意目標信息

- Stronger inhibition 抑制力提高
  - Inhibit distractors. 抑制分心物

Conclusion (1) 結論(1)

- Keep listening to and speaking L2, facilitate automatisation of L2 processing! 不斷訓練聽、說能力，努力朝自動化語言處理的目標前進。
  - Better comprehension 理解內容
  - Greater fluency 口語流暢
  - Better attention and inhibition 注意力、抑制力提高

Long-Term Memory and WM
長期記憶與工作記憶的關係

- LTM provides some footing for WM. 長期記憶對工作記憶起到一定的輔助作用。

- Expert chess players recall chess positions better than novice players (Robbins et al. 1996; Gobet & Simon, 1996). 西洋棋專家比西洋棋初學者記住更多棋子的位置

Long-Term Memory and WM

- Non-word recall and repetition is affected by "word-likeness" (Gathercole et al, 1991)
- 虛構字的記憶受 "字的逼真性" 影響

Loddenapish *vs.* Defermication

Long-Term Memory and WM

- "The left fielder made a great catch. It was the best play of the **day**."
- （"左外野手接得漂亮。這是今天最精彩的一球"）

- Baseball fans can remember and recall more sentence-final words in baseball related sentences than non-fans. (Fincher-Kiefer et al. 1988; Hambrick & Engle, 2002) 棒球迷比一般人記住更多句尾詞。
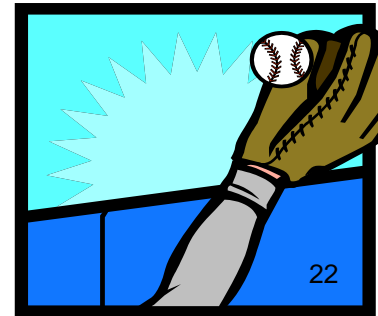
Conclusion (2)

- Domain-specific knowledge helps increase vWM capacity for more L2 information and enhances selective attention and inhibition. 處理專業領域的信息時，專業領域知識能提高工作記憶的能力。

- Keep reading widely and taking in knowledge as much as you can. 廣泛閱讀，擴大專業領域知識面！

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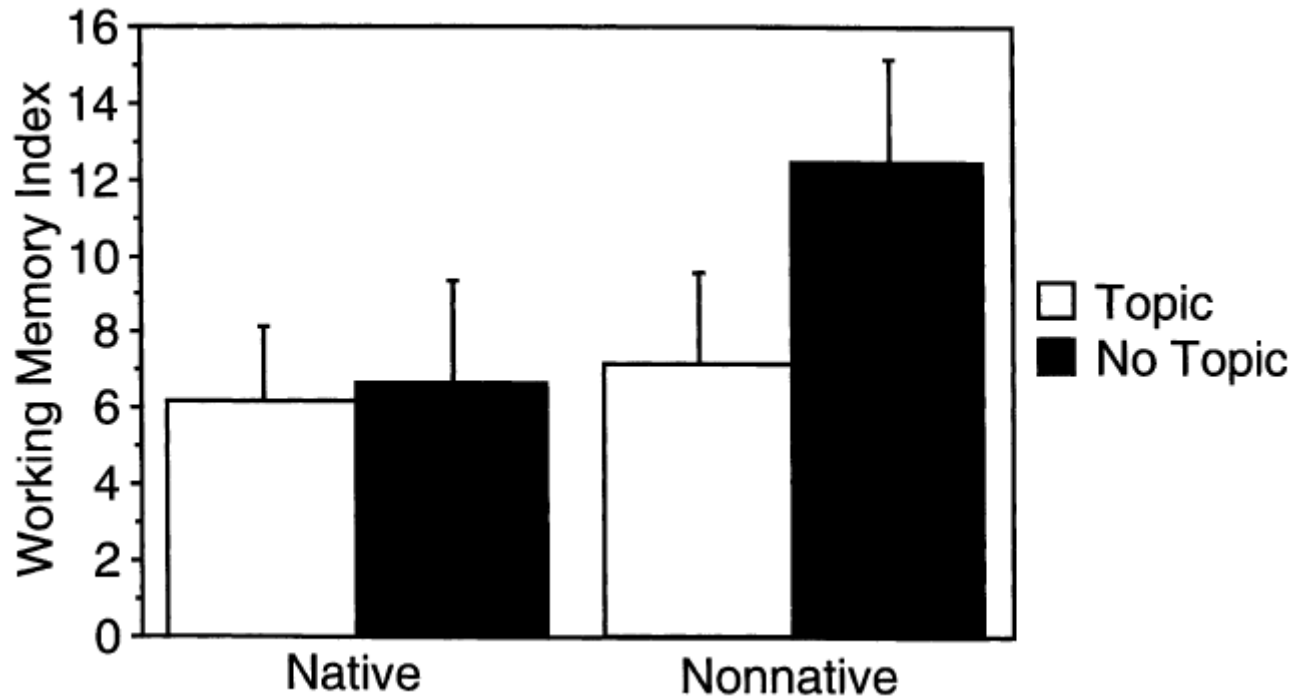
Tyler (2001)
Topic knowledge helps relieve vWM load in L2

"The procedure is actually quite simple. First you arrange things into different groups. Of course, one pile may be sufficient depending on how much there is to do. If you have to go somewhere else due to a lack of facilities, that is the next step, otherwise you are pretty well set…" (Bransford & Johnson, 1972).

"步驟其實很簡單。首先，把東西按種類加以分類。當然，視東西數量的多寡，也許一堆就夠了。如果缺乏設備需要換個地方，就可以現在換地方，要不然就差不多可以開始了…"

Topic knowledge helps relieve vWM load
話題知識有助於減輕工作記憶的負擔

(Tyler, 2001)