# 附錄一：台灣手語、美國手語手譯員的手語數字短期記憶廣度比較

Articulatory Suppression Effects on Short-term Memory of Signed Digits and Lexical Items in Hearing Bimodal-Bilingual Adults

**發音抑制在雙管道-雙語言手譯員數字記憶廣度的影響**

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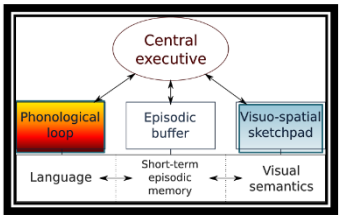
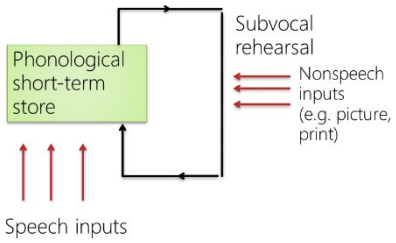
## 工作記憶(Working memory)

- WM plays an important role in language development, learning and reading.
- 短期記憶Short term memory (STM)have significant relationship with language abilities.
- Digit STM span task is most common measures of the STM

## Beddeley’s 工作記憶模式




## 口語為主的音韻迴路機制




## 音韻迴路的三種效應Three effects of phonological loop

- 音韻相似效應
  - Phonological similarity effect
- 字長效應
  - Word length effect
- 發音抑制效應
  - Articulatory suppression effect

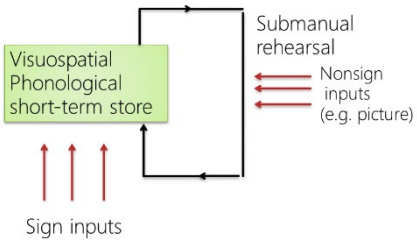
## 發音抑制效應

- Articulatory suppression effect means when people were asked to do some irrelevant articulatory, they can not memorize information well.
- The Short-term Memory Span is reduced when subjects must perform irrelevant mouth movements, such as repeating ” ta, ta,ta,” during presentation of a list of words to be remembered.(Murray, 1968)

## 三種效應也存在手語的記憶歷程

- 手語音韻相似效應
  - Phonological similarity effect
- 手語字長效應
  - Word length effect
- 手語發音抑制效應
  - Articulatory suppression effect
  - Producing meaningless movements of the hands yielded poorer memory performance.

## 手語的音韻迴路機制(Emmorey,2002)



## 類似的記憶機制存在口語及手語使用者

Speech phonological loop for speakers
Sign phonological loop for signers
- Speakers exhibits speech articulatory suppression effect
- Signer exhibits manual articulatory suprression effect

## 手語的短期記憶廣度比口語短的可能原因是.....？

## 實驗一

- 目的：透過發音抑制效應去檢測手譯員究竟是使用口語或手語的音韻迴路
- 方法：我們調查漢語/台灣手語手譯員其台灣手語(TSL)的數字記憶廣度
- 假設：
  - 1.會出現口語的抑制效應，而不會有手語的抑制效應。
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## 參與者

- 32**位漢語/台灣手語手譯員**
- 來自台灣的北中南三區
- 聽力正常
- 翻譯年數：3-29 (*M* = 12.50, *SD* = 7.49). 平均年齡：Their average age ranged from 24 to 65 years old (*M* = 39.66, *SD* = 12.11).
- 性別： 男4 女28
- 所有人都是長大後才學手語的手譯員

## 手語音韻迴路和口語音韻迴路的不同

- the short term memory span of sign language is much shorter than that of speech.
  - The average STM capacity of spoken language is 7 ± 2
  - The average STM capacity when using American Sign Language is 5± 1

- 手譯員熟悉手語及口語兩種管道，那他在記憶手語時，會啟動手語還是口語的音韻迴路呢？

實驗一

## 研究方法

## 任務和刺激

- 所有的參與者被要求觀看電腦螢幕上的手語數字，然後把它記住，再依序把剛剛看到的手語數字一一打出來
- 所有的手語數字是由一位聾人以每秒一個數字的速率打出

## 任務和刺激

| items | example1 | example2 |
|---|---|---|
| 3 items | 1,6,5 | 2,4,8 |
| 4 items | 2,5,7,9 | 1,9,5,3 |
| 5 items | ..... | ..... |
| 6 items | ..... | ..... |
| 7..... | ..... | ..... |
| 8 ..... | | |
| 9 ..... | | |

## 自變項

- 四種發音抑制
- 無抑制No suppression
  - Participants just see the stimuli
- 口語抑制Oral suppression
  - Participants see the stimuli and were asked to say" ta, ta. ta," continually at the same time
- 手語抑制Sign suppression
  - Participants see the stimuli and were asked to open and close their hands continually at the same time

口語及手語抑制

- Participants see the stimuli and were asked to say" ta, ta, ta," and open and close their hands continually at the same time

## 依變項

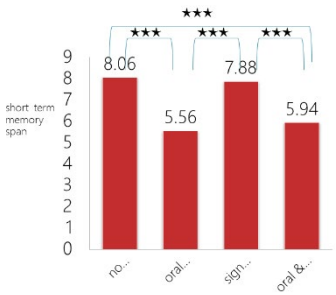
- 短期記憶廣度
  - the longest list length at which at least one of the two lists was recalled correctly.
  - According to the WAIS(Wechsler Adult Intelligence Scale) definition,

## 實驗程序

- 個別化進行
- 筆記型電腦
- 每個參與者都要接受四種發音抑制下的手語數字短期記憶廣度測驗
- 各種發音抑制狀況的順序採對抗平衡設計
- 分析方法
  - ANOVA

## 結果

## 不同抑制下手語數字記憶廣度




## 變異數分析ANOVA 和事後考驗 Post Hoc

- ANOVA: $F_{(3.93)}=74.02$ , $P<.001$; $\eta^2=.71$
- Pairwise comparision ($P<.001$)
  - None suppression > oral suppression
  - Oral articulatory suppression effect exists.
  - It means they use the sound subvocal rehearsals.
  - They use the speech loop.

- No significant difference between non suppression and sign suppression
  - There is no sign articulatory suppression effect .
  - These hearing interpreters do not use Sign loop.

- when participants remember lists of sign digit, they will translate these signs to speech and rehearsal the sounds of the digits.
- When they were asked to do some irrelevant oral articulatory, they cannot rehearsal and retain the sounds of digits easily.

## 實驗一 結果

- TSL interpreters tended to use "speech loop", not "sign loop" to remember the sign digits.
- From the interviews, they report they did use speech rehearsal to remember these signs, not the sign .

## 實驗二研究參與者

- 15位美國手語翻譯員或已在大學修習過手語翻譯課程的大學生
- 美國德州
- 年齡19 to 32 years (*M* = 21.93, *SD* = 3.43)
- they had been learning ASL for an average of 5.40 years (*SD* = 5.53, Range = 1.5 to 20.0 years).

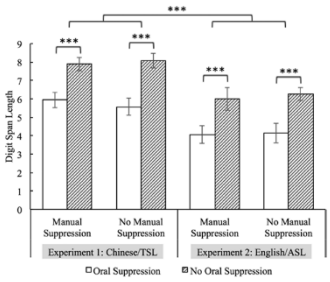
## 任務和實驗程序

- 和實驗一相同，但台灣手語數字換成美國手語數字1-9
- 由一年輕聾成人擔任演示者
- 其餘程序均和實驗一相同

## 結果

- 無抑制 6.27 (*SD* = 0.70)
- 口語抑制 4.13 (*SD* = 1.06
- 手語抑制6.00 (*SD* = 1.25)
- 口語及手語抑制4.07 (*SD* = 0.96)

## 結果(實驗一及實驗二比較)




- 語言有明顯的主要效果, $F(1,45) = 40.19$, $p < .001$, $p\eta 2 = .472$.
- 表示 Chinese/TSL 雙語者的手語記憶廣度明顯比English/ASL 要長
- 在發音抑制變項上亦有明顯主要效果, $F(1,45) = 246.54$, $p < .001$, $p\eta 2 = .846$, 表示口語抑制下的廣度明顯比非口語抑制下的廣度短

## 重要結果

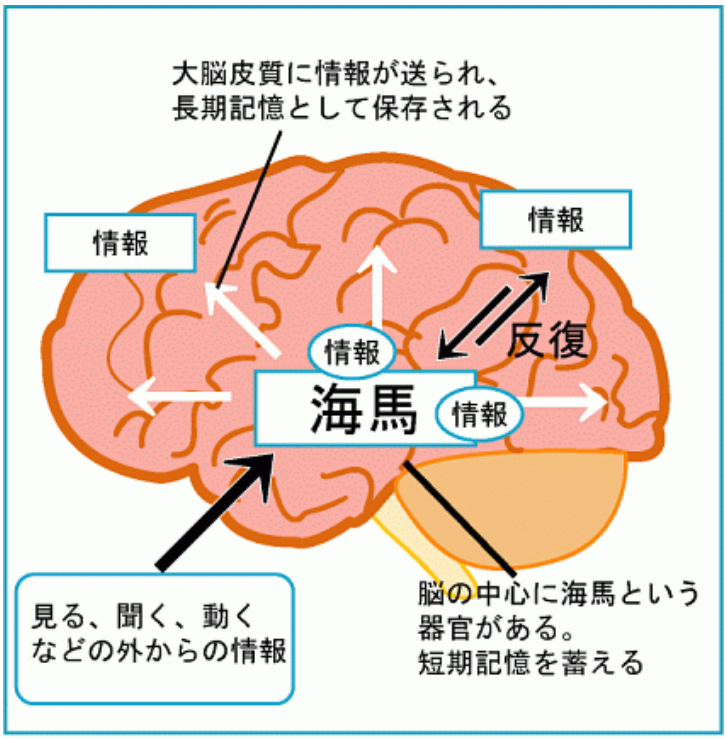
- 不管是台灣或美國的手譯員在記憶手語數字時，都是以口語進行內在的複誦
- 台灣手譯員的手語數字記憶廣度明顯比美國手譯員的長

## 討論

- 為什麼手譯員在記憶手語數字時，會採用口語複誦？

## 討論

- 台灣手譯員的手語數字記憶廣度明顯比美國手譯員的長

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