



Humor and Creativity Processing: An fMRI study

幽默和創造力歷程之fMRI研究

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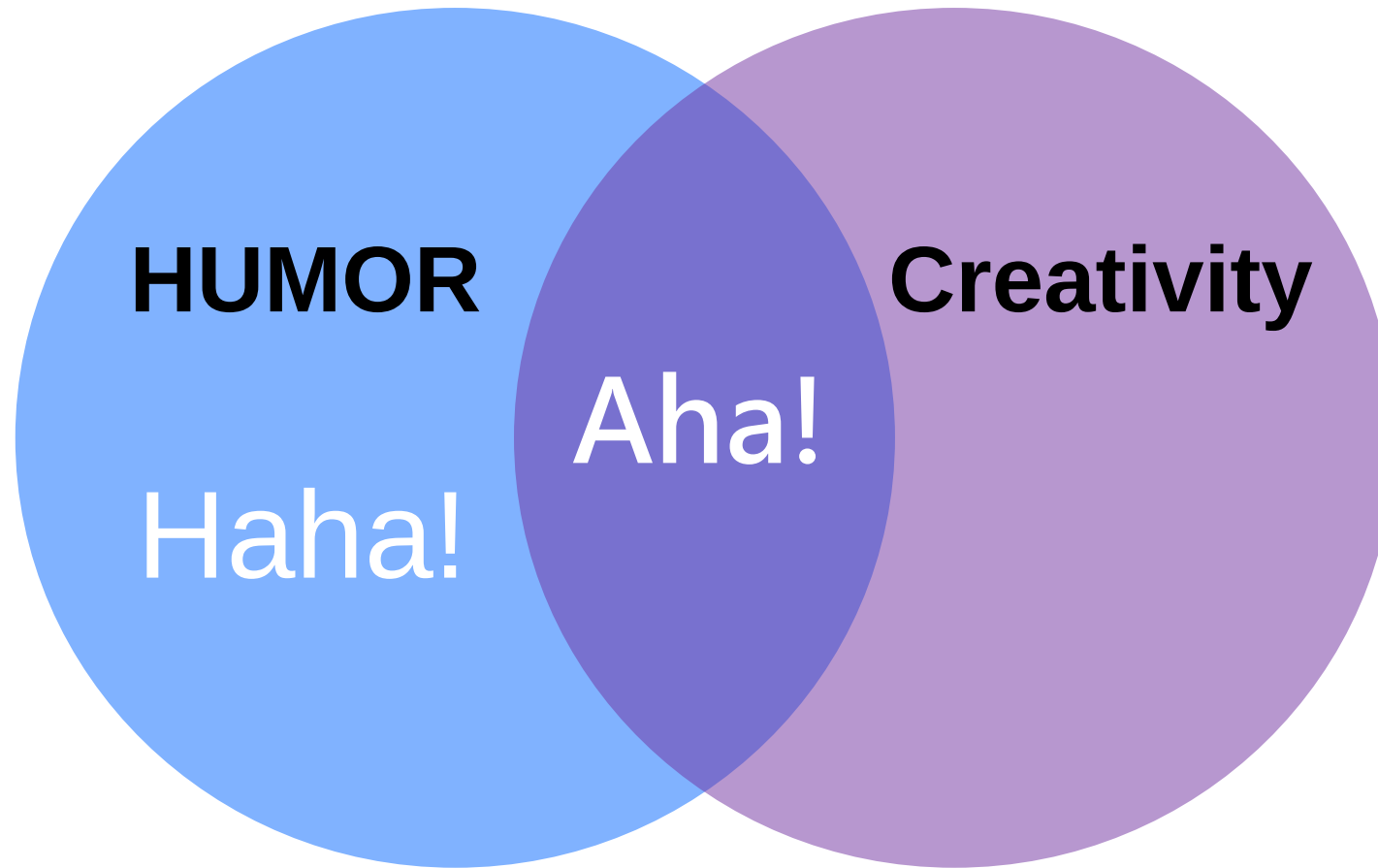
CHAN LAB

NTHU

研究動機與目的

- ❖ 儘管幽默和創造力都會引發驚喜和隨之欣賞經驗，但尚不清楚在兩者的歷程中是否涉及共同或不同的有效性連結模式。
- ❖ 本研究使用動態因果模式（DCM）和貝式參數實徵（PEB）的分析來探討兩階段幽默和創造力歷程中**杏仁核**和**額頂葉網絡**之間的有效性連結之fMRI研究。
 - Amygdala-frontoparietal effective connectivity

幽默和創造力



被動欣賞

- ❖ 幽默歷程（被動）：幽默理解和幽默欣賞
- ❖ 創造力歷程（主動）：想出創新點子和評估

研究動機與目的

❖ 本研究探討幽默和創造力的營造（ setup ）和關建（ punch line ）階段的歷程

- 典型：
 - 失諧解困幽默
 - 替代用途的創造力
- 非典型：
 - 無厘頭幽默
 - 美感用途的創造力
- 基準線（ baseline ）

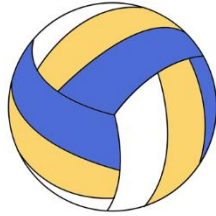
幽默歷程

- ❖ 幽默歷程：營造階段和關鍵階段
- ❖ 本研究關注**中腦邊緣路徑**（ mesolimbic pathway ）在創造力和幽默歷程中的**關鍵階段**（ punch line stage ）

Participants

- ❖ **Sixty healthy**, right-handed volunteers (Oldfield, 1971), with no history of psychiatric or neurological diseases, participated in this study (30 men and 30 women; 20 to 33 years old, with a mean age of 22.99 ± 2.30).

Humor



Volleyball

Typical



Incongruity-resolution humor
(IR)

incongruity and resolution

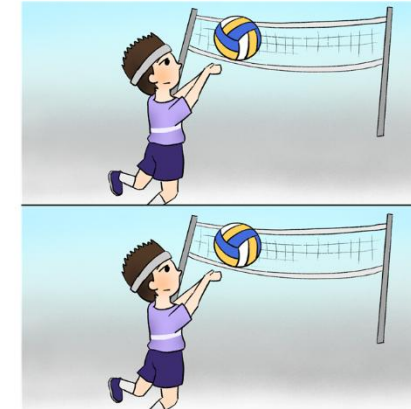
Atypical



Nonsense humor
(NS)

Incongruity only

Baseline



Non-humor
(HB)

Familiar, not funny

Setup

Punch line

Creativity

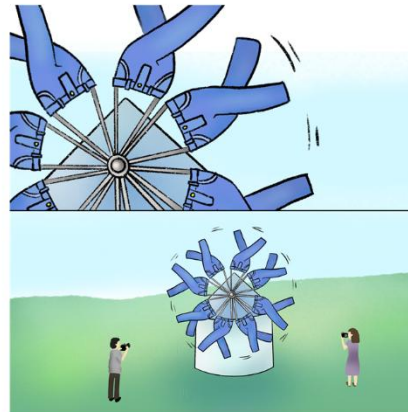


Jeans



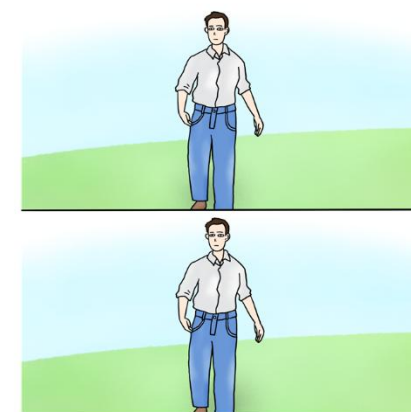
Alternate uses
(AU)

Novel and useful



Aesthetic uses
(AES)

Novel, not useful



Non-creative uses
(CB)

Familiar and useful

Setup

Punch line

Stimuli

- ❖ The creative stimuli consisted of three forms:
- ❖ (1) **Alternate uses (AU) stimuli**, the typical form, displaying novel uses of existing objects with practical benefits;
- ❖ (2) **Aesthetic uses (AES) stimuli**, the atypical form, displaying novel uses of existing objects with pleasing or interesting aesthetic qualities; and
- ❖ (3) **Noncreative uses baseline (CB) stimuli**, or neutral stimuli, displaying ordinary objects used in familiar ways.

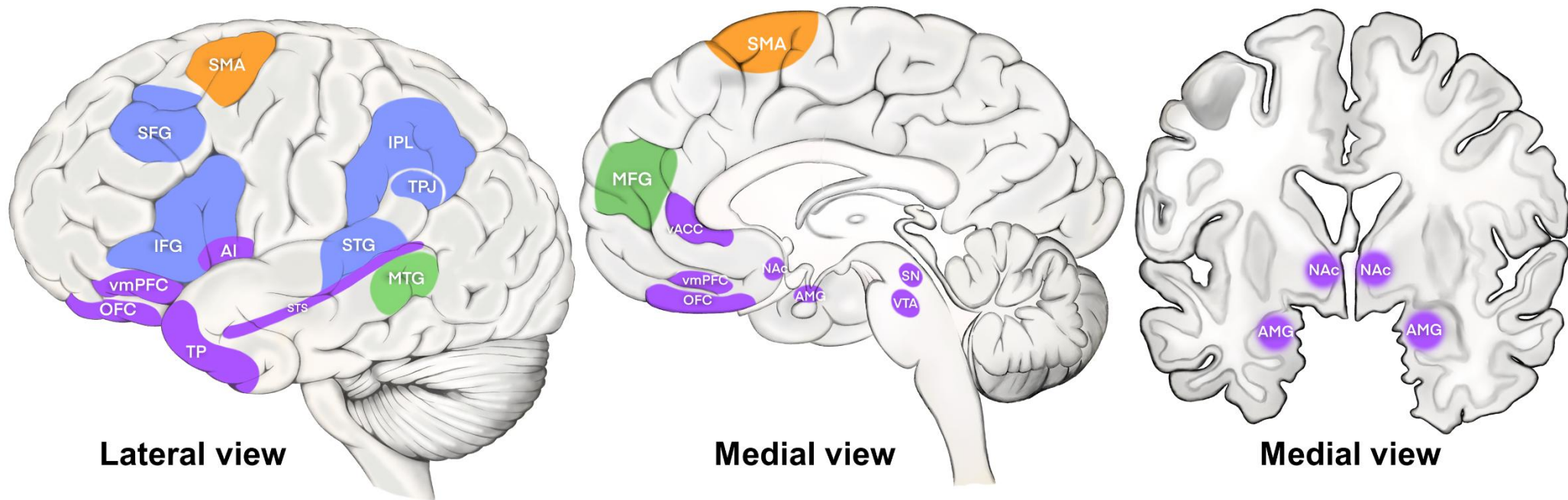
Stimuli

- ❖ The study also used three distinct forms of stimuli to study humor processing:
- ❖ (1) **Incongruity resolution humor (IR) stimuli**, the typical form, involving humor requiring the detection and resolution of an incongruity;
- ❖ (2) **Nonsense humor (NS) stimuli**, the atypical form, involving humor based on the incongruity via obviously impossible, unreal, abnormal, absurd, and/or exaggerated situations; and
- ❖ (3) **Nonhumor baseline (HB)**, or neutral stimuli, displaying familiar, (and nonamusing) people, objects, or situations.

Stimuli

- ❖ Each participant was presented with 96 stimuli.
 - **16** two-panel stimuli for each of the six conditions.

Humor processing: Humor comprehension, appreciation, and expression



Humor comprehension

Incongruity

Resolution

Humor appreciation

Amusement

Humor expression

Laughter

Five nodes

❖ 中腦邊緣系統 (mesolimbic) 網絡

- Midbrain: Ventral tegmental area (**VTA**) 中腦腹側蓋區
- **Amygdala (AMG)** 杏仁核

❖ 預設模式網絡 (DMN)

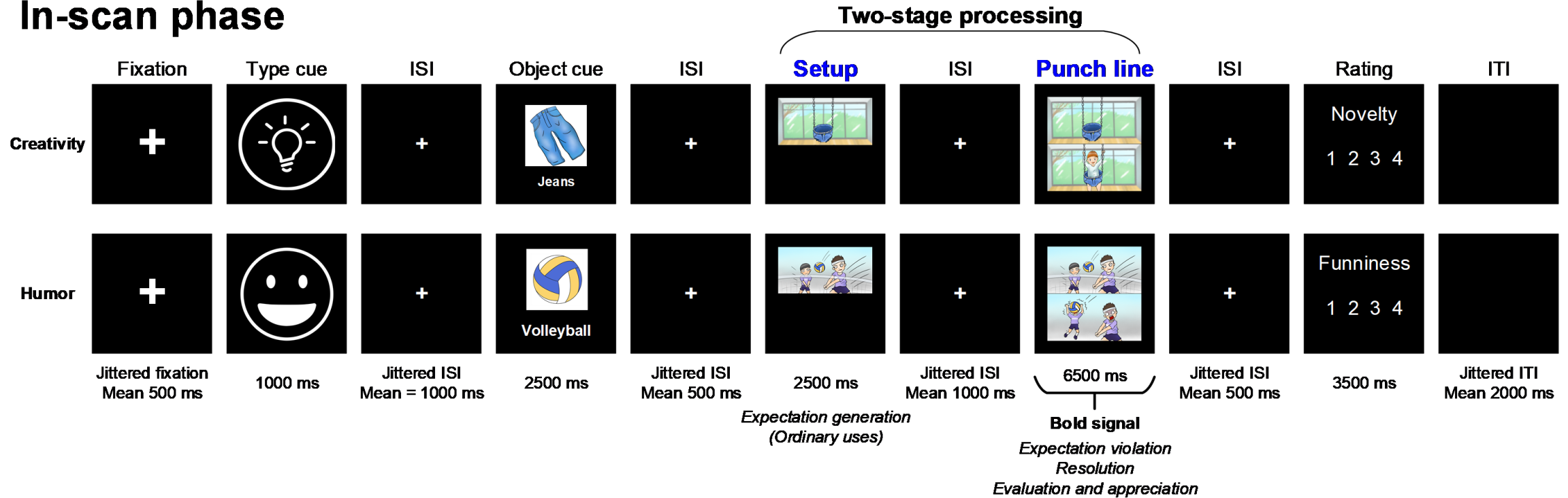
- Precuneus (PCu) 楔前葉

❖ 執行控制網絡 (ECN)

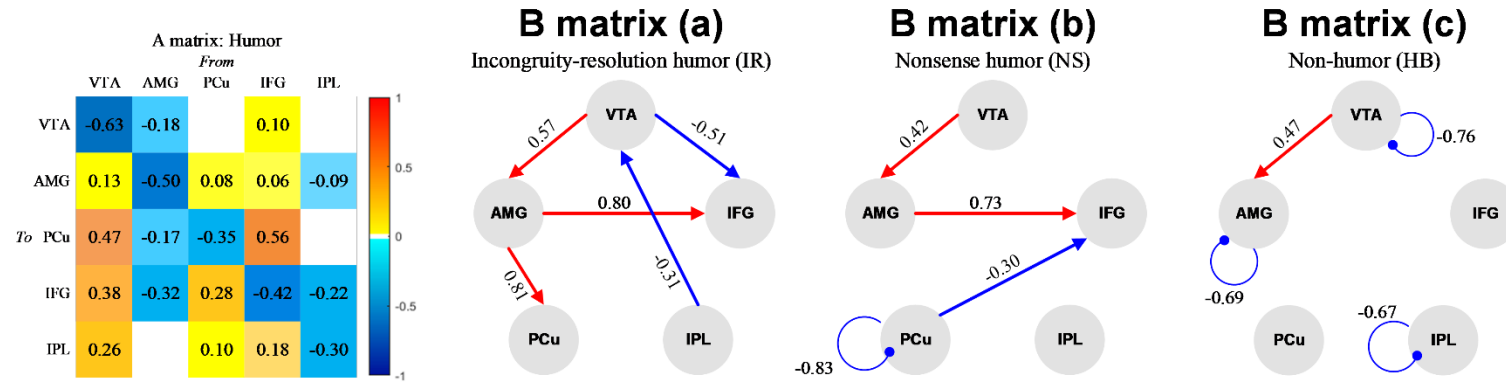
- Inferior frontal gyrus (IFG) 額下回
- Inferior parietal lobule (IPL) 頂下葉

實驗流程

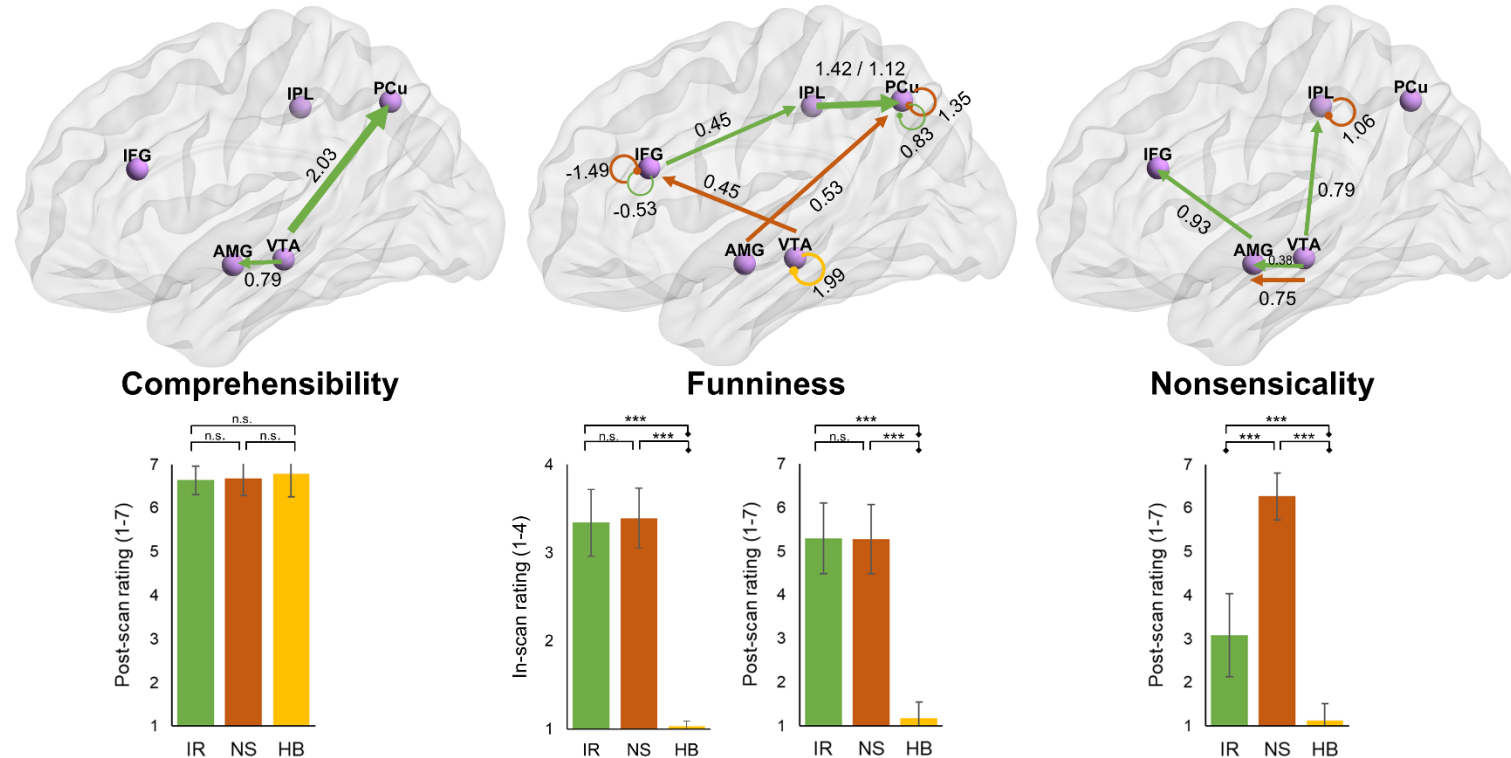
In-scan phase



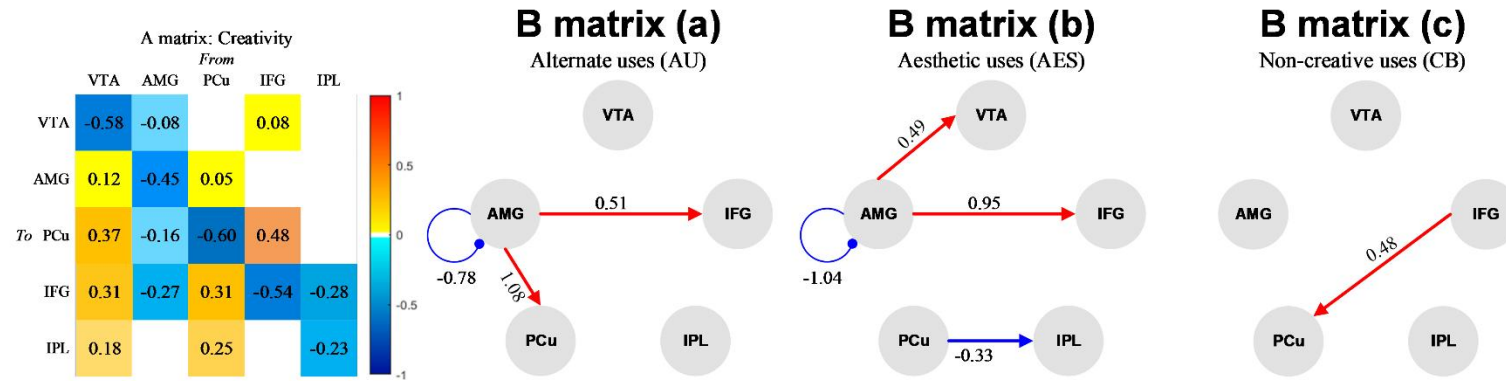
(A) Effective connectivity during humor processing



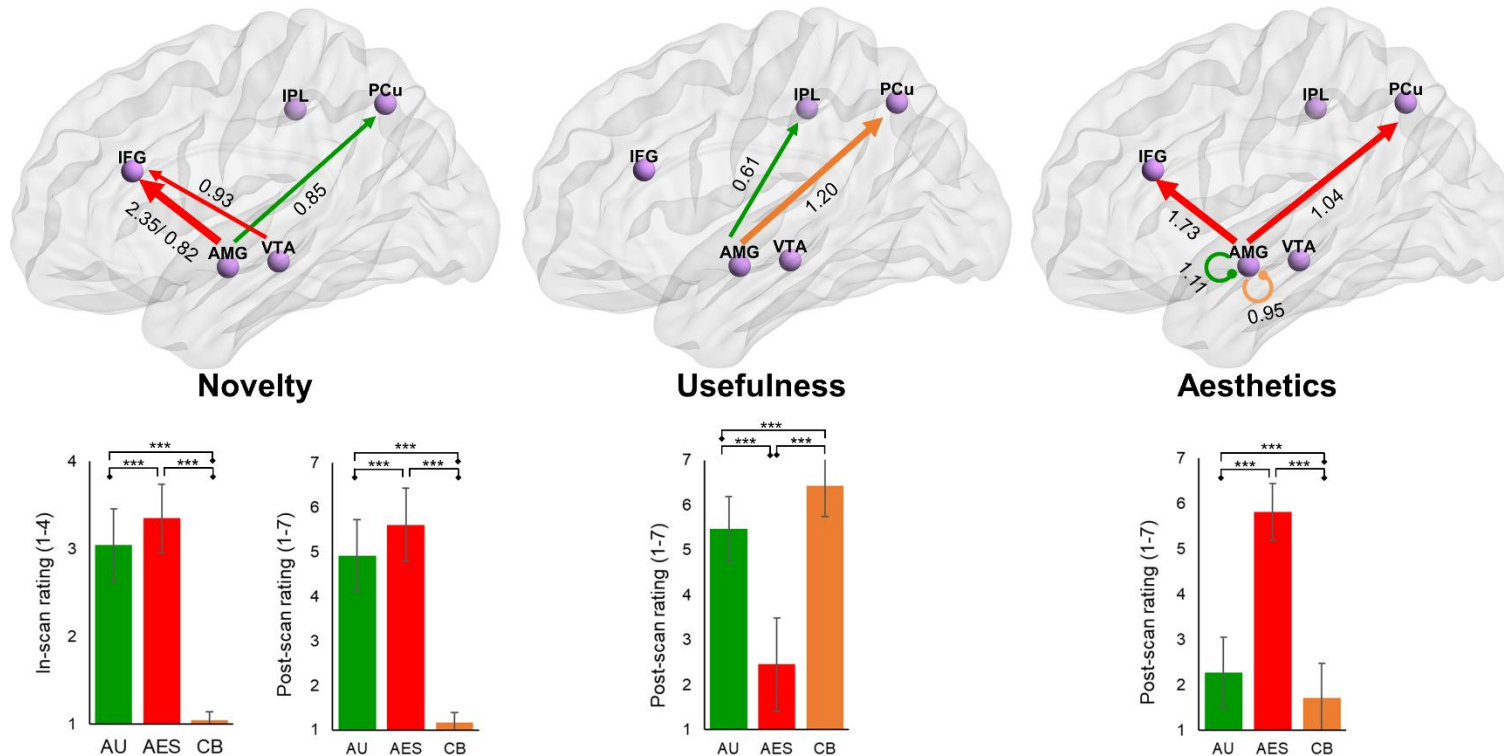
(B) Effective connectivity with ratings during humor processing



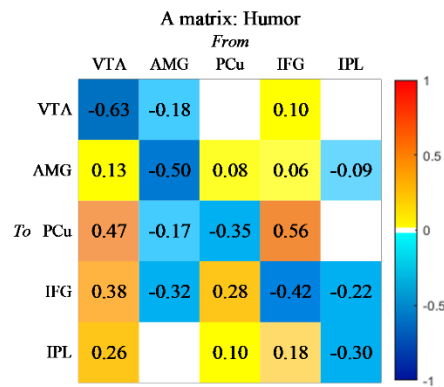
(A) Effective connectivity during creativity processing



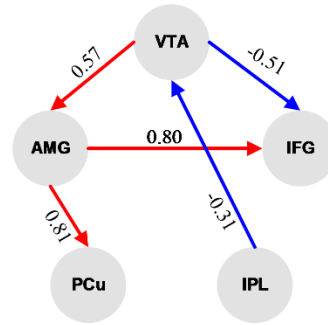
(B) Effective connectivity with ratings during creativity processing



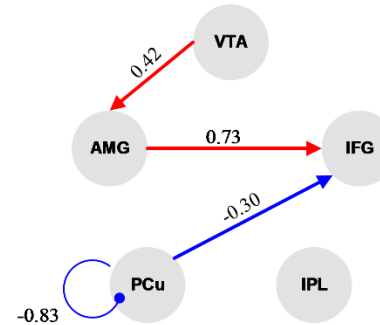
(A) Effective connectivity during humor processing



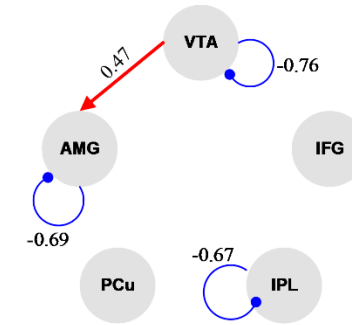
B matrix (a)
Incongruity-resolution humor (IR)



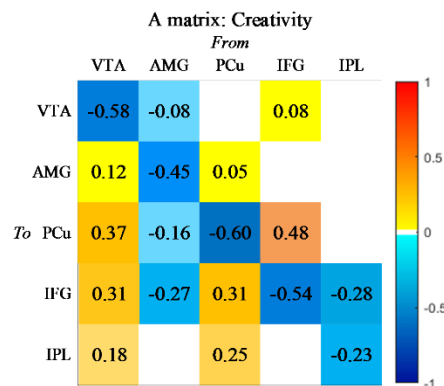
B matrix (b)
Nonsense humor (NS)



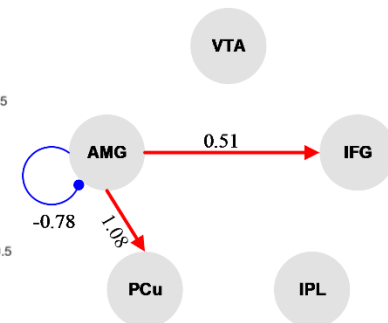
B matrix (c)
Non-humor (HB)



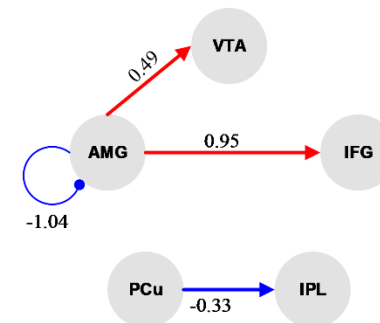
(A) Effective connectivity during creativity processing



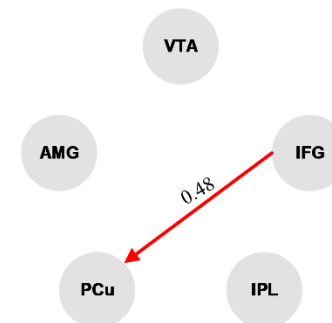
B matrix (a)
Alternate uses (AU)



B matrix (b)
Aesthetic uses (AES)

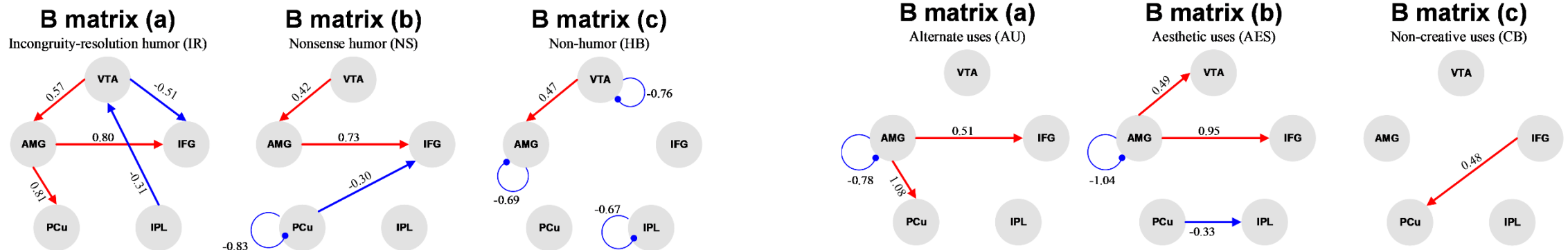


B matrix (c)
Non-creative uses (CB)



The amygdala → IFG

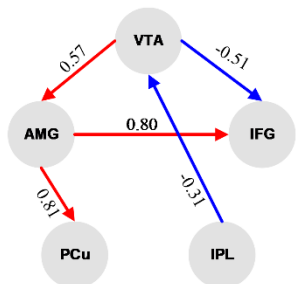
- ❖ 本研究顯示，杏仁核（amygdala）在預期違反（expectation violation）和欣賞（appreciation）中扮演重要角色。
- ❖ amygdala → IFG 對於典型（typical）和非典型（atypical）形式的幽默和創造力扮演重要角色，這 amygdala → IFG 涉及預期違反到解困的歷程。



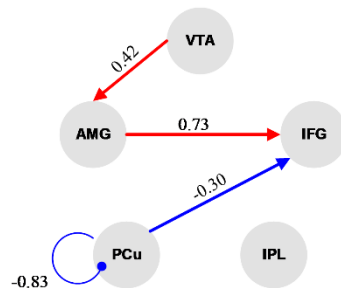
The amygdala → precuneus

- ❖ amygdala → precuneus 對於典型形式的幽默和創造力扮演重要角色，
- ❖ 這 amygdala → precuneus 涉及涉及理解他人意圖（ understanding other's intentions ）的失諧解困幽默
- ❖ 以及替代用途的創新性（ novelty ）和有用性（ usefulness ）的評估

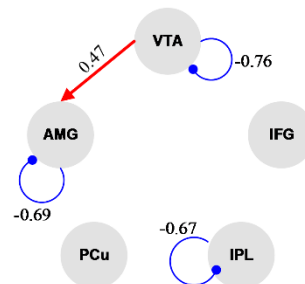
B matrix (a)
Incongruity-resolution humor (IR)



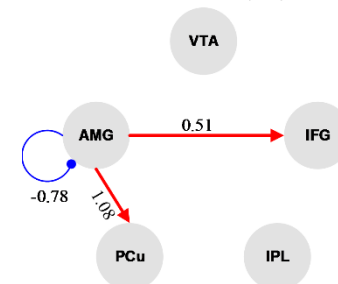
B matrix (b)
Nonsense humor (NS)



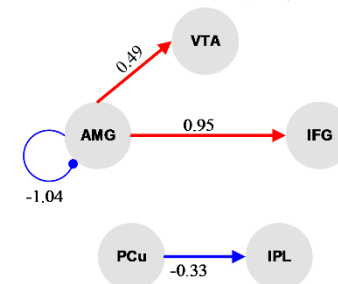
B matrix (c)
Non-humor (HB)



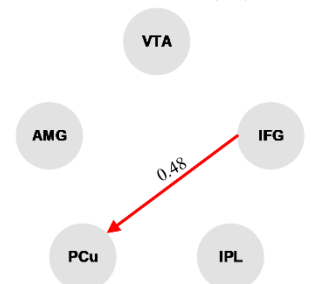
B matrix (a)
Alternate uses (AU)



B matrix (b)
Aesthetic uses (AES)



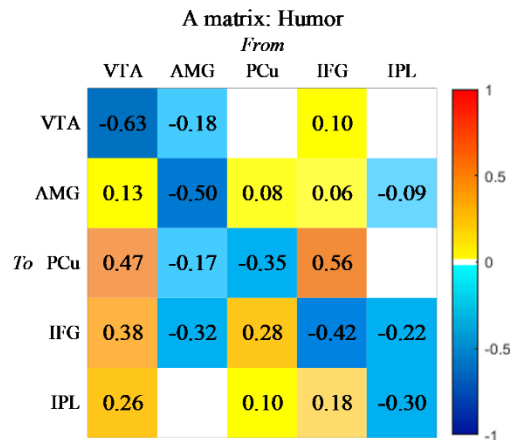
B matrix (c)
Non-creative uses (CB)



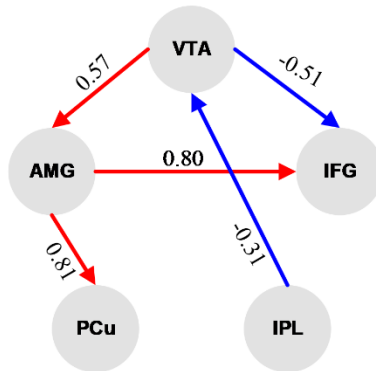
The VTA → amygdala

❖ VTA → amygdala 涉及典型（失諧解困幽默）和非典型（無厘頭幽默）的幽默欣賞（humor appreciation）

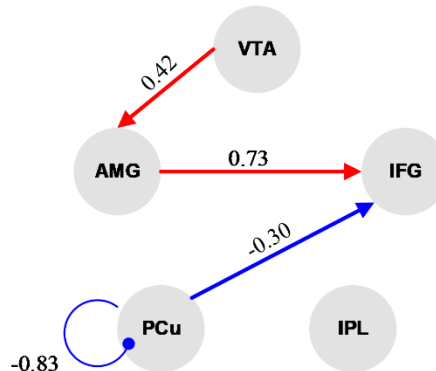
(A) Effective connectivity during humor processing



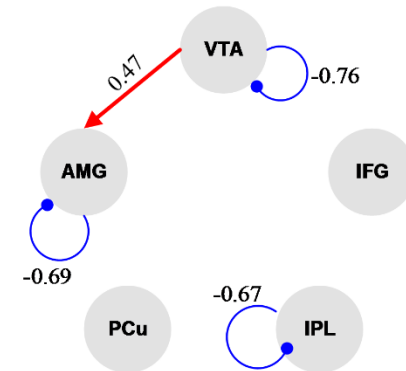
B matrix (a)
Incongruity-resolution humor (IR)



B matrix (b)
Nonsense humor (NS)



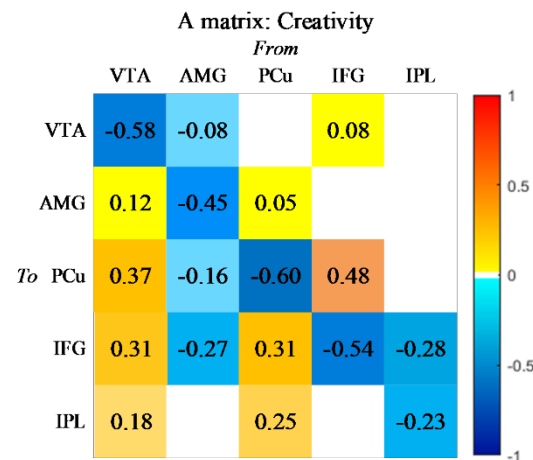
B matrix (c)
Non-humor (HB)



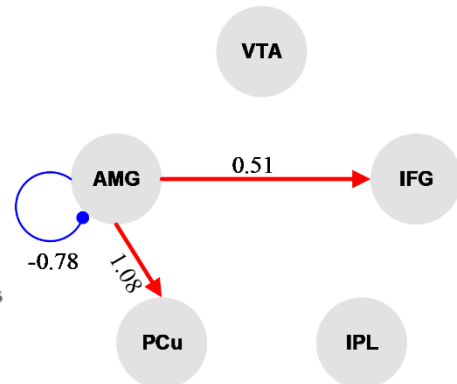
The amygdala → VTA

❖ amygdala → VTA 涉及非典型（美感用途）的美感欣賞（aesthetic appreciation）

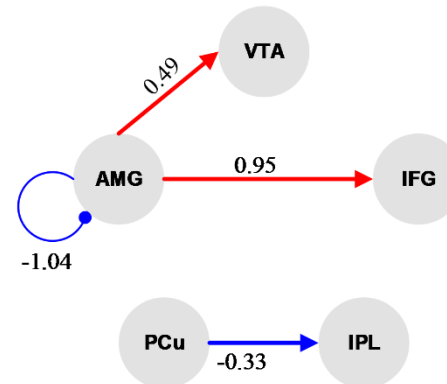
(A) Effective connectivity during creativity processing



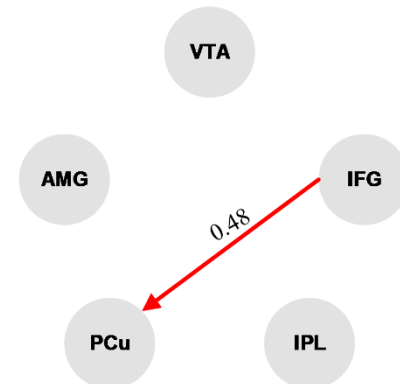
B matrix (a)
Alternate uses (AU)



B matrix (b)
Aesthetic uses (AES)



B matrix (c)
Non-creative uses (CB)



Leave-one-out cross-validation (LOO-CV)

- ❖ The usefulness score during post-scan ratings correlated with the amygdala → precuneus coupling ($r = .31, p = .008$) for the noncreative uses baseline condition (CB).
- ❖ The funniness scores correlated with the amygdala → IFG ($r = .32, p = .006$) couplings for incongruity-resolution humor

The amygdala-frontoparietal networks

- ❖ 這些研究結果顯示杏仁核和額頂葉迴路（ amygdala-frontoparietal circuitry ）在幽默和創造力歷程扮演重要角色



Thank You !

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Institute of Learning Sciences and Technologies

Cognitive and Hedonic-Affective Neuroscience Lab (CHAN Lab)

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