

Neural Correlates of Recollection and Familiarity

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Recollection (REC) vs. Familiarity (FAM)

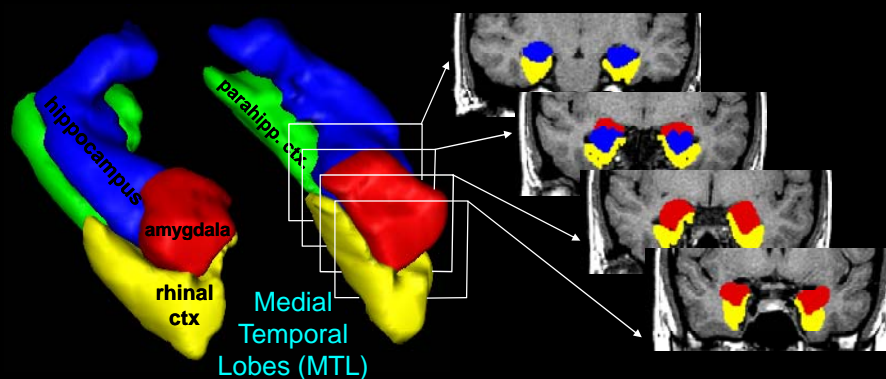
- **Recollection (REC)**
 - Remembering an event including specific contextual details
- **Familiarity (FAM)**
 - Knowing that an event occurred in the past in the absence of specific details (e.g., face recognition)
- **Methods for measuring REC and FAM**
 - Confidence ratings and ROC curves
 - Remember/Know paradigm
 - Relational memory
- **Behavioral dissociations (Yonelinas, 2002)**
 - Several factors affect REC but not FAM
 - speeding, divided attention, generation, semantic encoding
 - Several factors affect FAM but not REC
 - response criterion, short term forgetting, perceptual manipulations

Neural Correlates of REC and FAM: Outline

Four fMRI studies:

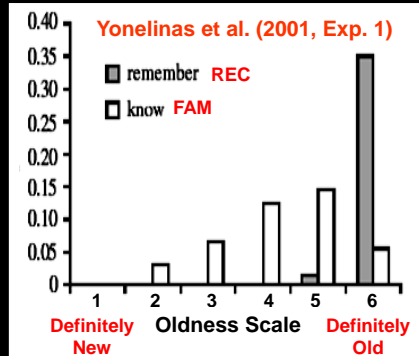
- **Recognition confidence**
 - Daselaar et al. (2006, J Neurophys)
- **Emotional memory**
 - Dolcos et al. (2005, PNAS)
- **Relational memory encoding vs. retrieval**
 - Prince et al. (2005, J Neurosci)
- **Episodic encoding vs. semantic retrieval**
 - Prince et al. (2007, Psych Sci)

REC has been associated with the hippocampus, and FAM, with rhinal cortex

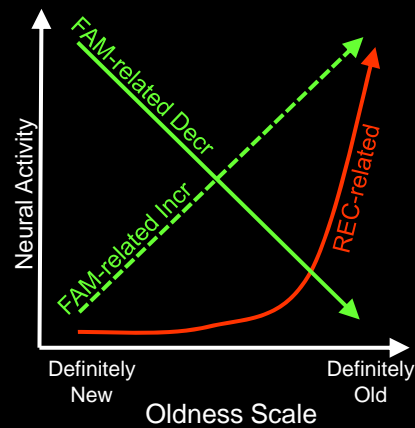


- Supported by abundant lesion, electrophysiology, and imaging evidence
 - Aggleton & Brown (1999), Eichenbaum et al. (1994, 2007)
- Until recently, however, no clear dissociations in humans

Distinguishing REC-related vs. FAM-related activity using confidence ratings

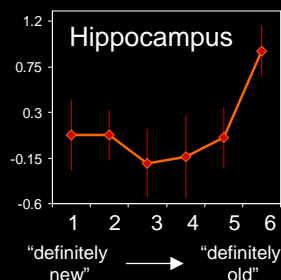
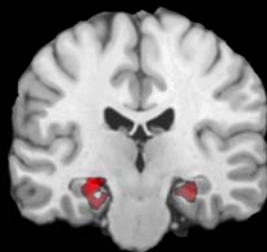


Behavioral studies suggest that FAM increases gradually as a function of confidence, whereas REC increases suddenly for the highest level of confidence

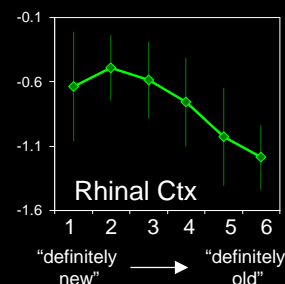
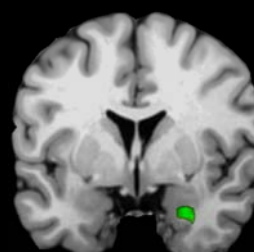


We predicted a dissociation between the hippocampus and rhinal ctx

Hippocampal activity increased abruptly for the highest level of confidence (REC), whereas rhinal activity decreased gradually with confidence (FAM)



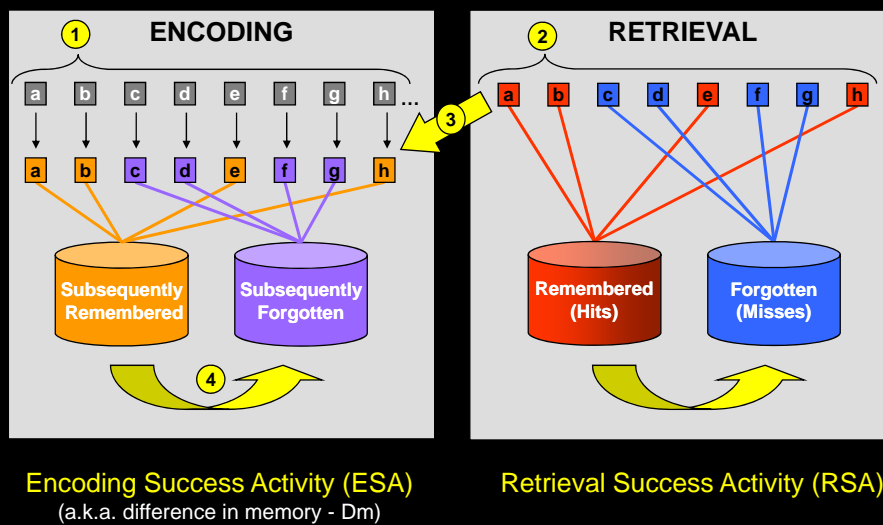
Daselaar et al. (2006)
J Neurophys



Emotional Memory

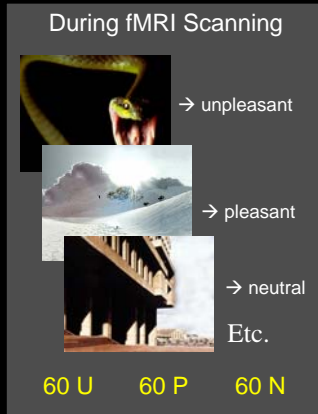
- Emotional events are remembered better than neutral events
 - Review: LaBar & Cabeza (2006, *Nature Rev Neurosci*)
- Modulation hypothesis → the memory-enhancing effect of emotion reflects a direct influence of the amygdala on the hippocampus
 - e.g., McGaugh
- The memory-enhancing effect of emotion is driven by recollection, not familiarity
 - e.g., Ochsner (2000)

Identifying Successful Encoding and Retrieval Activity using Event-Related fMRI



fMRI of Emotional Memory

ENCODING



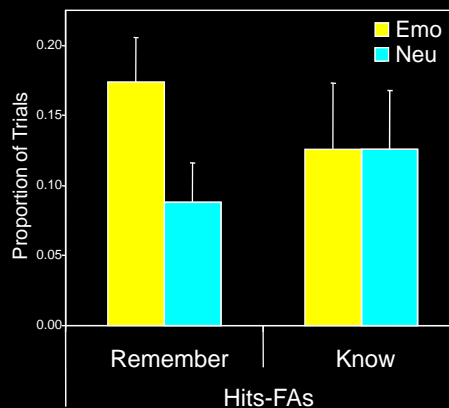
~ 1 YEAR
INTERVAL

RETRIEVAL



time →

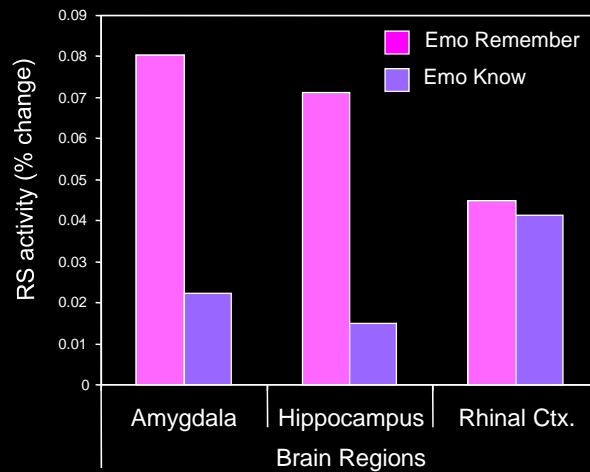
Recognition memory one year later:
The memory-enhancing effect of emotion
was driven by recollection, not familiarity



Dolcos, LaBar, &
Cabeza
(2005, PNAS)

- Consistent with behavioral studies (e.g., Ochsner, 2000)

Emotional RSA was greater for recollection than familiarity in the amygdala and the hippocampus, but not in rhinal cortex



Dolcos, LaBar, & Cabeza (2005, PNAS)

Amygdalar-hippocampal correlations were significant mainly for items that were both emotional and recollected

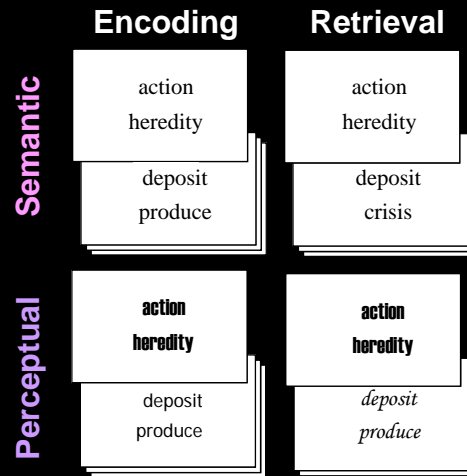
| MTL regions | AMY-MTL correlations: R scores (emotional rRS) | AMY-MTL correlations: R scores (neutral rRS) | AMY-MTL correlations: R scores (emotional kRS) | AMYgdala-MTL correlations: R scores (neutral kRS) |
|--------------------|--|--|--|---|
| AMY (R) | N/A | N/A | N/A | N/A |
| HC (head) (R) | 0.94**** | 0.97**** | 0.98**** | 0.86* |
| HC (body) (L) | 0.82* | - | 0.9*** | - |
| HC (tail)/PPHG (R) | 0.87** | - | - | - |
| HC (tail)/PPHG (L) | 0.77* | - | 0.81* | 0.76* |



Implications for post-traumatic stress disorder (PTSD)...

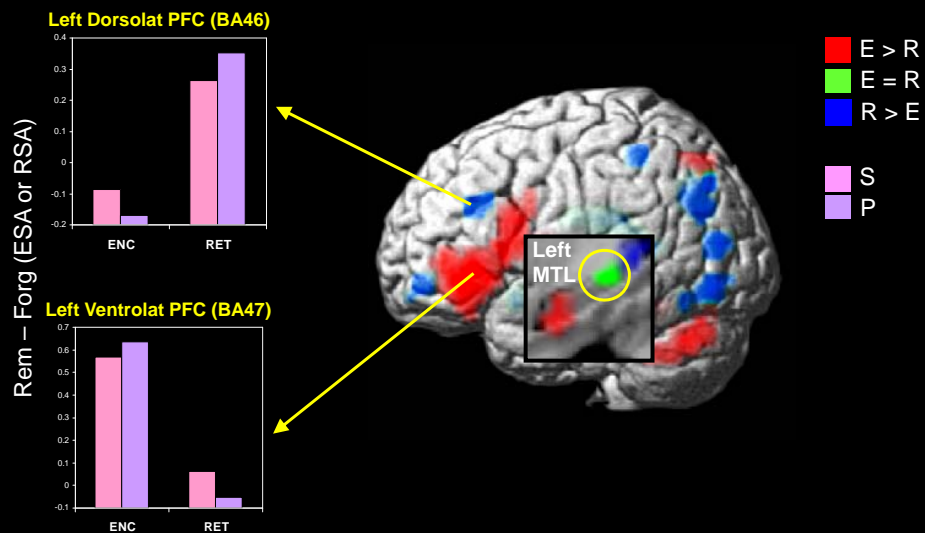
Dolcos, LaBar, & Cabeza (2005, PNAS)

Relational Memory Encoding vs. Retrieval: Semantic vs. Perceptual Associations



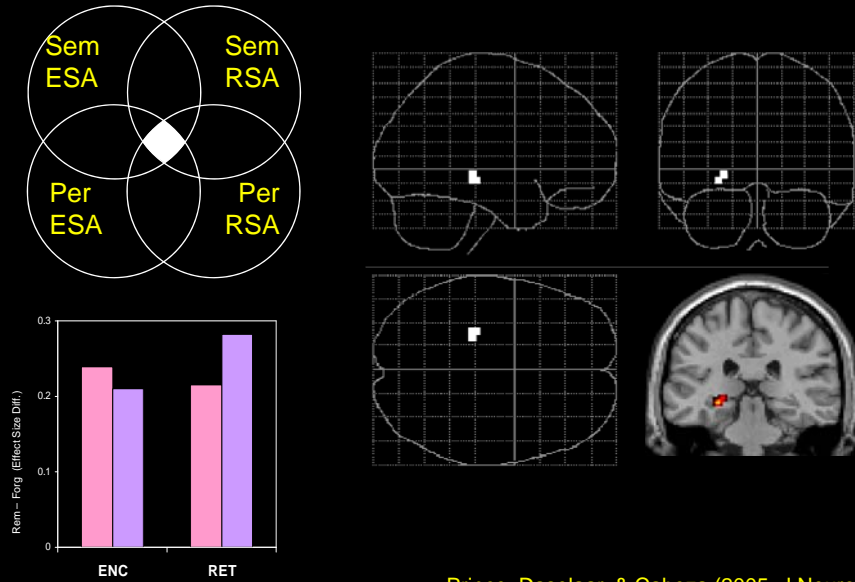
Prince, Daselaar, & Cabeza (2005, J Neurosci)

Encoding-Retrieval Dissociations within PFC and within MTL



Prince, Daselaar, & Cabeza (2005, J Neurosci)

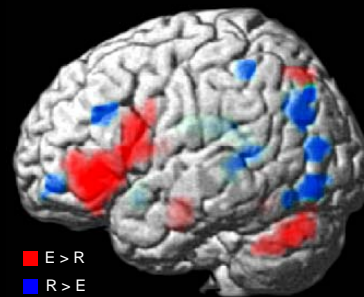
Quadruple Conjunction: Left Hippocampus



Prince, Daselaar, & Cabeza (2005, J Neurosci)

Episodic Encoding (EE) vs. Semantic Retrieval (SR)

- **Intimately related**
 - when participants are asked to memorize a list of items (intentional EE), they tend to do so by processing the meaning of the information (incidental SR)
 - conversely, when they are asked to retrieve semantic information (intentional SR), they tend to encode the learning event into episodic memory (incidental EE)
- **EE & SR → ≈ brain regions**
 - E.g., Left ventrolateral PFC
 - Shared processes or just confound?
 - need to disentangle EE and SR
- **Used factorial design →**

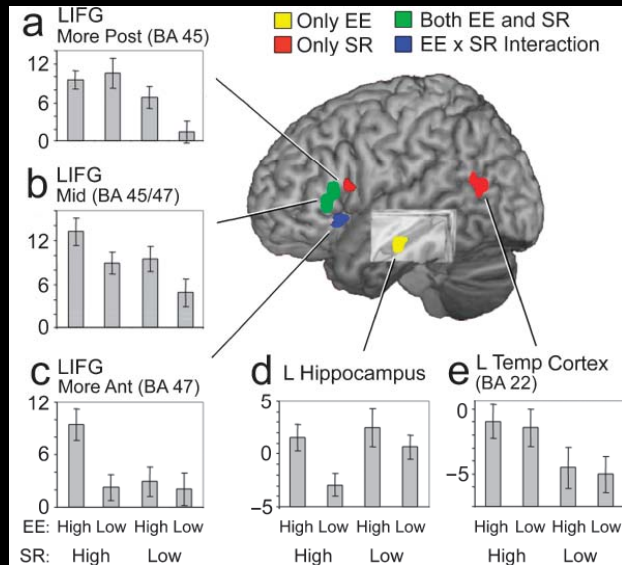


| | | Episodic Encoding | |
|--------------------|-----------|-------------------|----------|
| | | High (EH) | Low (EL) |
| Semantic Retrieval | High (SH) | SH/EH | SH/EL |
| | Low (SL) | SL/EH | SL/EL |

Episodic Encoding vs. Semantic Retrieval

- **Hippocampus**
 - EE but not SR
 - Episodic-semantic
- **Left temp ctx**
 - SR but not EE
 - near Wernicke's area
- **L vIPFC gradient:**
 1. BA45: SR > EE
 2. BA45/57: SR + EE
 - Consistent with link between SR & EE
 3. BA47: SR x EE int
 - Controlled EE
 - ≠ hipp: EE is automatic (independent of SR)

→ False memory (Kim & Cabeza, 2007)



Prince, Tsukiura, & Cabeza (2007, Psych Science)

Neural Correlates of REC and FAM: Summary

- **Recognition confidence** (Daselaar et al., 2006, J Neurophys)
 - Hippocampal activity increased abruptly for the highest confidence level (REC), whereas rhinal activity decreased gradually with confidence (FAM)
- **Emotional memory** (Dolcos et al., 2005, PNAS)
 - Emotional RSA was greater for REC than FAM in the amygdala and the hippocampus, but not in rhinal cortex
 - Amygdalar-hippocampal correlations were significant mainly for items that were both emotional and recollected → REC-emotion synergy
- **Relational memory encoding vs. retrieval** (Prince et al., 2005, J Neurosci)
 - PFC: ventrolateral (Enc > Ret) vs. dorsolateral (Ret > Enc)
 - MTL gradient: ant (Enc>Ret), mid (Enc=Ret), post (Ret>Enc)
- **Episodic encoding vs. semantic retrieval** (Prince et al., 2007, Psych Sci)
 - Hippocampus (EE, not SR) vs. left temporal cortex (SR, not EE)
 - BA47: EE x SR interaction → controlled processes (vs. automatic hipp)