

# The neural correlates of everyday recognition memory.

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## Introduction

Recognition is often assumed to be the result of two distinct memory processes (Mandler, 1980): *Recollection* is the ability to remember contextual details about an event (e.g., thoughts, sensory experiences); *Familiarity* is the feeling of knowing the event took place in the absence of specific contextual information. The majority of recognition memory studies have used lab-based stimuli (e.g., Montaldi et al., 2006); in this study, we investigated recognition memory for *everyday* events using SenseCam, a novel automatic camera. SenseCam is activated by a range of environmental sensors and takes on average one image every 30 seconds. The resulting photographic diary allowed assessment of memory for everyday scenes taken without user involvement. Adapting the remember-know procedure (Tulving, 1985), we asked healthy undergraduates, who wore SenseCam for two days, to classify images as strongly or weakly remembered, strongly or weakly familiar or novel, while brain activation was recorded with functional MRI. A subsequent session run 5-6 months after the first was conducted to assess how the neural correlates for everyday events changes over time.

## Methods

**Participants:** 15 right handed undergraduates (aged 18-25) took part in a scanning session 36 hours after image acquisition. 10 participants also took part in a second scanning session 5-6 months later. Both scanning sessions had an identical procedure and lasted approximately 45 minutes.

**fMRI data acquisition:** Images were collected using a 1.5-T Phillips Gyroscan magnet. A T2\*-weighted EPI sequence was used (Tr = 3000ms, Te = 45ms, flip angle = 90°, 32 transverse slices, 3.5 x 2.5 x 2.5mm). 280 volumes were acquired in each of the two runs per subject.

**Stimuli:** 120 SenseCam images were presented. 80 were images from events they had participated in ("old" images) and 40 were images acquired by other participants ("new") possessing the same general characteristics (e.g., similar types of event, locations, level of brightness).

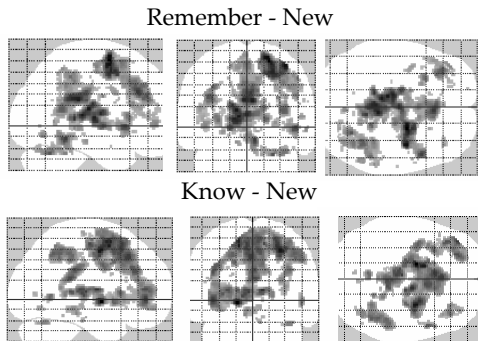
**Procedure:** Trials began with a blank screen lasting between 250-3750ms followed by a fixation cross for 150ms. An image was then presented for 4000ms. This was followed by instructions, which remained on the screen for 3000ms, asking participants to classify the image as "Remember", "Know", or "New". "Remember" and "Know" responses were made using the response box in one hand, "New" responses using the response box in the other hand. For "Remember" judgments, participants then had to distinguish between a high and a low level of detail whilst "Know" images were divided into high and low familiarity. Responses indicating a high level of detail and high familiarity were made using the same hand, as were responses indicating a low level of detail and low familiarity. For "New" images, participants had to press any button.

**Data Analysis:** Analyses were conducted using SPM5. A threshold of  $p < .001$  and a cluster threshold of 10 were used for whole brain analyses. Region of interest (ROI) analyses, comprising the medial temporal lobes (MTL), were conducted using thresholds of  $p < .01$  and 10 contiguous voxels.

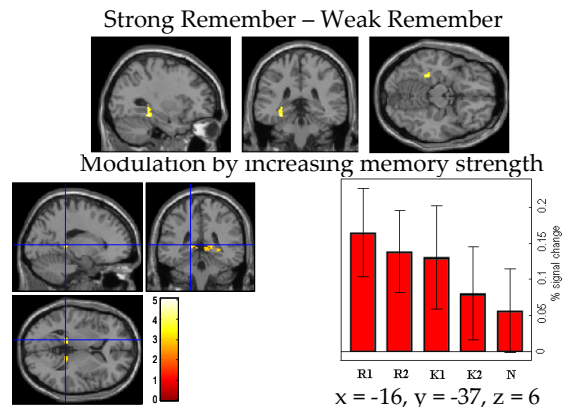
## Results

### Scanning 36 hours after image acquisition.

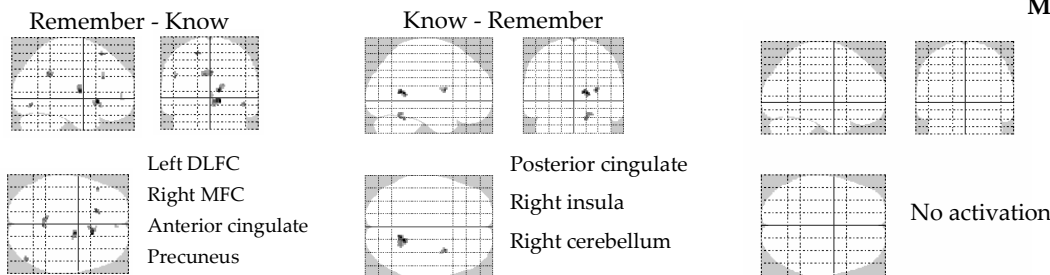
#### Whole Brain Analysis



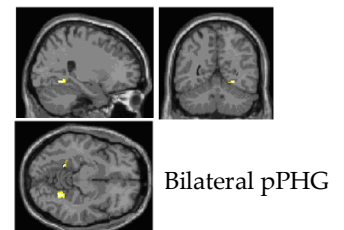
#### MTL analyses



### Scanning 5-6 months after image acquisition.



#### MTL analyses



## Discussion

For the 36 hour recognition delay, we found that: i) compared with novel stimuli, remembered and familiar items are associated with activation of overlapping, widely distributed sets of brain regions; ii) activation of the *right* hippocampus and bilateral posterior parahippocampal gyrus (pPHG) is associated with increasing memory strength, from novel through familiar to recollected items; iii) strong recollection is distinguished from weak recollection by activation of the *left* hippocampus/pPHG. At the 5-6 month delay, recollection activated neocortical structures but not MTL; long term familiarity activated pPHG and several neocortical regions. In summary, MTL is implicated in recollection at short delays, but, over months, activity associated with recollection becomes independent of hippocampus.

## References

Mandler, G. (1980). Recognizing: the judgment of previous occurrence. *Psychol Rev.*, 87, 252-271; Montaldi, D et al. (2006). The neural system that mediates familiarity memory. *Hippocampus*, 16, 504-520; Tulving, E. (1985) Memory and consciousness. *Can Psychol*, 26, 1-12.