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How basic emotions and emotional congruency with context interact to influence memory

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Introduction

Information congruent with prior knowledge is remembered better than incongruent information. This **effect of congruency** on memory is attributed to facilitatory influence of activated schemas on memory encoding and consolidation [1].

Also, **emotionally charged items** or events are often remembered better, whereas a paradoxical loss of specificity is found for **associative memory of emotional** information [2]. Emotional enhancement and impairment effects were shown to engage different memory representations [3].

However, these effects were usually tested with regard to semantic congruency, using only visual stimuli, and emotion was characterized by valence and arousal [4].

How **emotional congruency** and basic emotions [5] (**disgust, fear**) influence associative memory for **words in communicative context of faces?**

Previous findings

The more semantically congruent was memorized material, the more engaged **mPFC**. The more incongruent, the more engaged was **HC** and other **MTL** structures [1, 6].

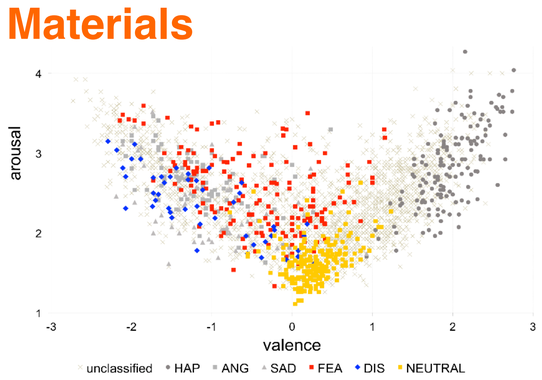
Memorizing associations was more effective for neutral than emotional materials. Reductions in associative encoding was related to **AMY** activity, whereas successful associative encoding was related to activity of **HC** [7].

There were more **gaze switches** between neutral than negative items, which reflected a **distribution of attention** and supported associative memory [7].

Participants

Exp. 1 n = 18, Exp. 2 n = 31; native Polish speakers (right-handed; aged 22-29, M=25.3, SD=3.1) without history of any neurological illness or treatment with psychoactive drugs, gave written informed consent and participated in a study.

Materials



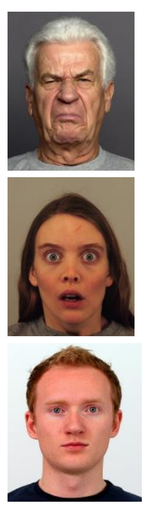


Fig. 1 Mean ratings from the Nencki Affective Word List (NAWL) [11]; emotional facial expressions from datasets: FACES [8], KDEF [9] and WSEFEP [10].

Procedure

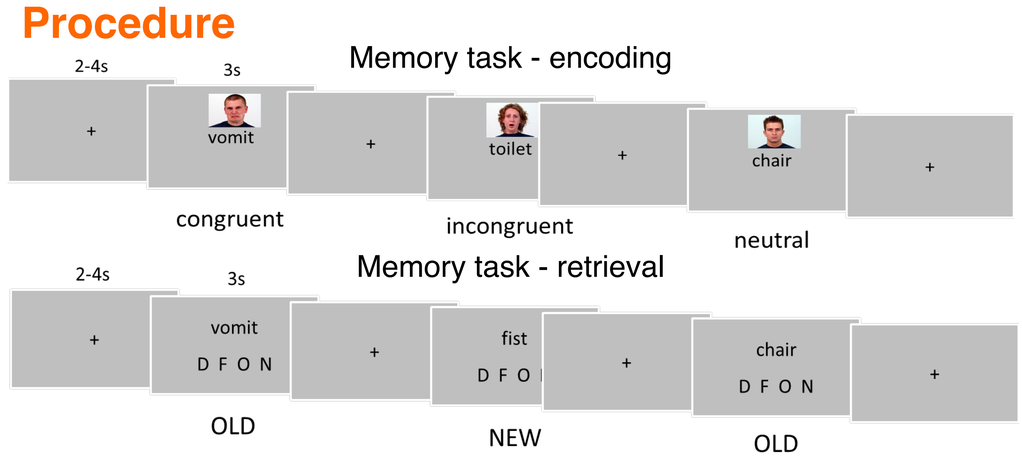


Fig. 2 Representation of experimental procedure with memory task during encoding and retrieval.

During each of 4 encoding sessions:
- 60 words were shown together with faces,
- associated with **DISGUST**, **FEAR** or **NEUTRAL**
- emotionally **congruent** or **incogruent.**

In each of 4 retrieval sessions:
- 105 words (60 OLD, 45 NEW) were shown
- participants indicated if they saw each word in the context of face expressing **DISGUST** (D), **FEAR** (F), **NEUTRAL** (O) or was **NEW** (N).

MRI data was acquired using a 3T Siemens Trio, 32-ch coil. The data were preprocessed using an SPM12 pipeline.

Exp. 1: fMRI

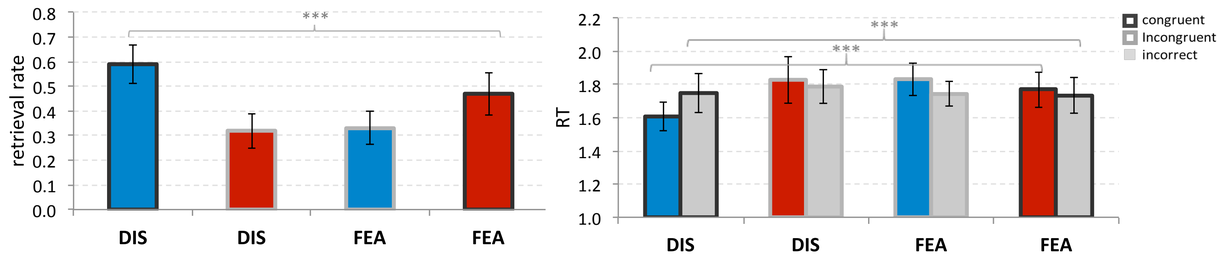
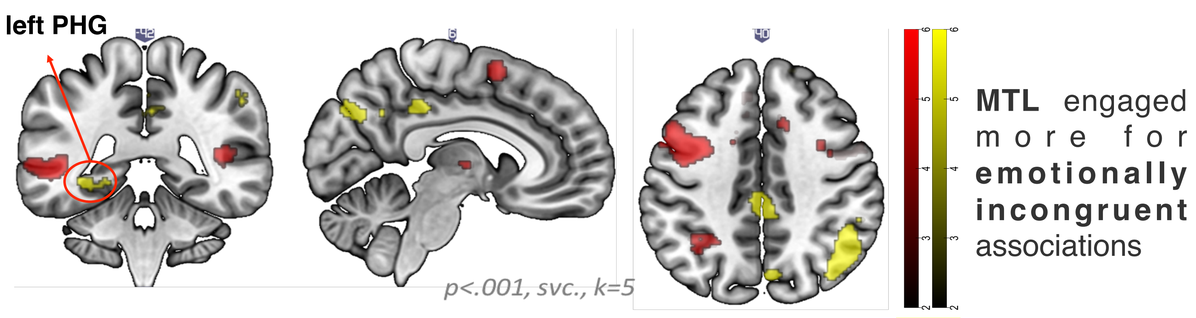
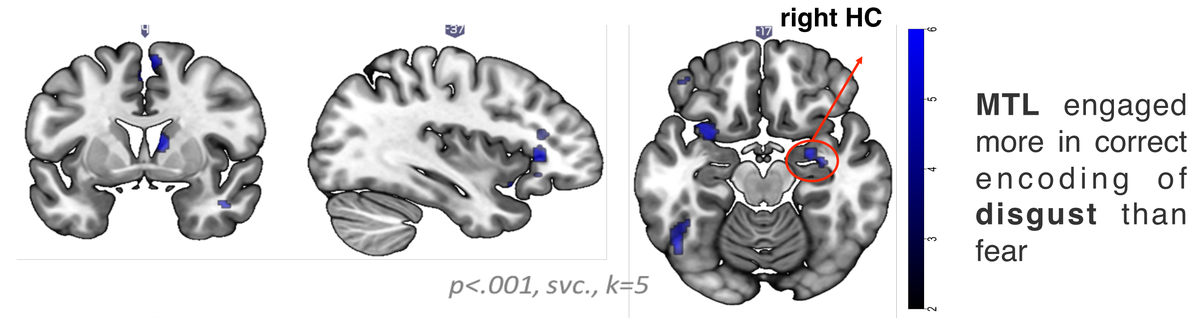


Fig. 3 a) Retrieval rate and b) RT for word and face pairs related to different basic emotion categories, emotionally congruent or incongruent, correct and incorrect.



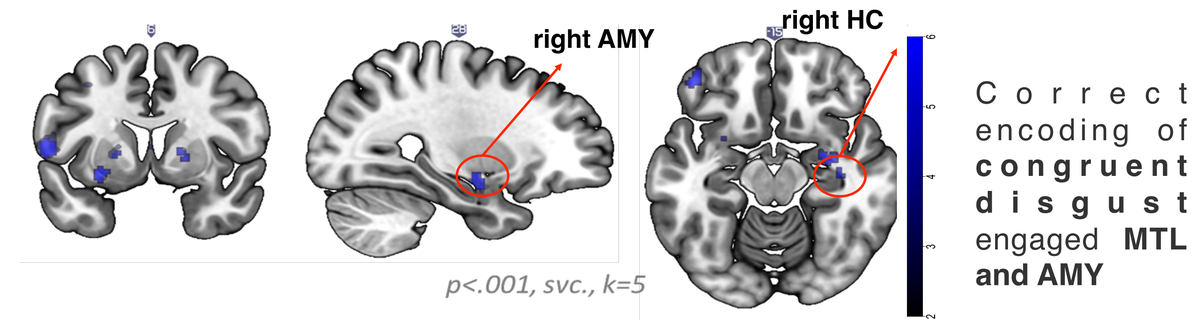
MTL engaged more for **emotionally incongruent** associations

Fig. 4 Brain activation during correct encoding: CONGRUENT > INCONGRUENT (red) and INCOGRUENT > CONGRUENT (yellow).



MTL engaged more in correct encoding of **disgust** than fear

Fig. 5 Brain activation during encoding correlated with behavioural parameters of CORRECTNESS and RT: subsequent retrieval of DISGUST > FEAR.



Correct encoding of **congruent disgust** engaged **MTL and AMY**

Fig. 6 Brain activation during encoding correlated with behavioural parameters of CORRECTNESS and RT: subsequent retrieval of CONGRUENT DISGUST.

Exp. 2: eye-tracking

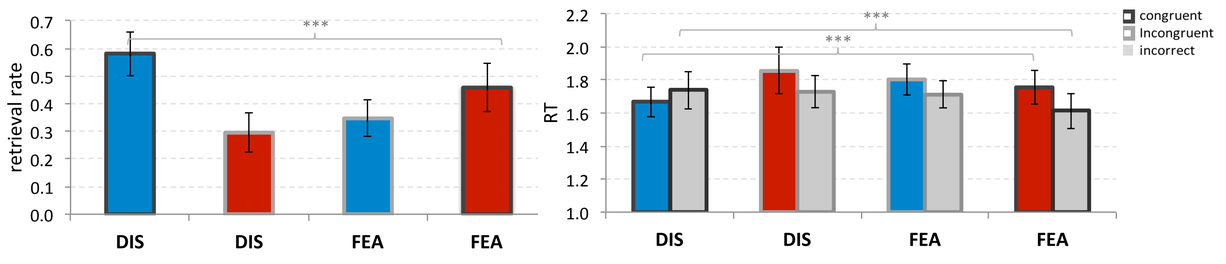


Fig. 7 a) Retrieval rate and b) RT for word and face pairs related to different basic emotions, emotionally congruent or incongruent, correct and incorrect.

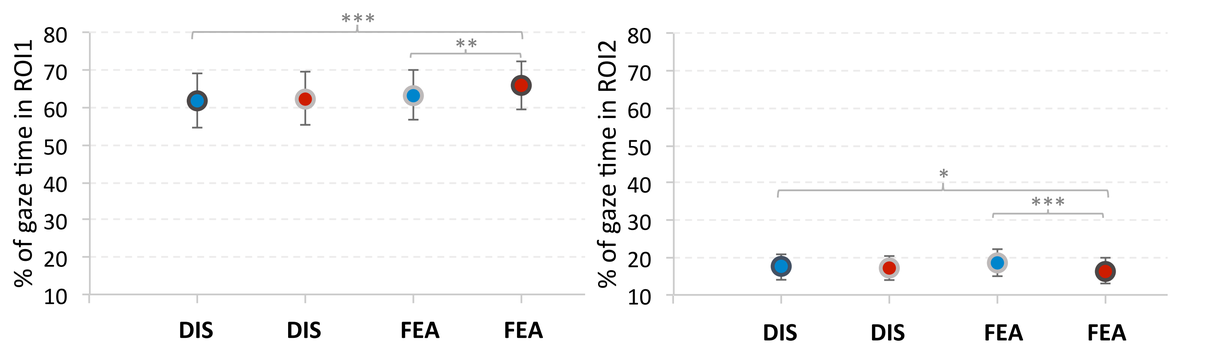


Fig. 8 a) Percentage of gaze time iin faces (ROI1) and b) percentage of gaze time in words (ROI2), during encoding related to different basic emotions, emotionally congruent or incongruent, correct and incorrect.

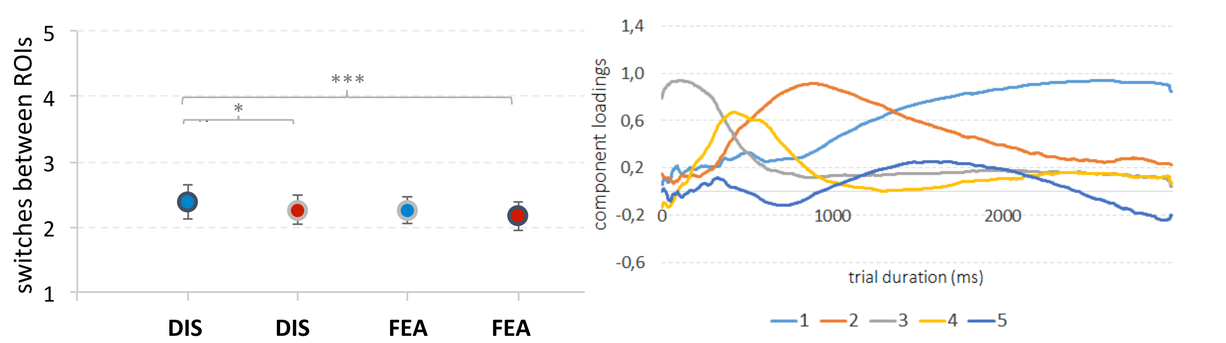


Fig. 8 a) Number of swithces between ROIs adn b) trial-wise principal components of pupil dilation during encoding word and face pairs related to different basic emotions, emotionally congruent or incongruent, correct and incorrect.

Correct encoding of **congruent fear** – more time observing **faces**, congruent **disgust** – more time observing **words** and more **switches** between faces and words

Congruent disgust – higher sympathetic (1) component loading, incongruent fear – higher parasympathetic (2) component loading in pupil dilation

Take-home message

- **Memory of affective language** was dependent on **emotional congruency** with its **face context** (more congruent - better remembered).
- It was also related to **basic emotions** (congruent disgust remembered better than congruent fear) and related to different attentional and neuronal mechanisms.

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