# Distinctive Images of Fear and Disgust?

Jan-Peter Lamke

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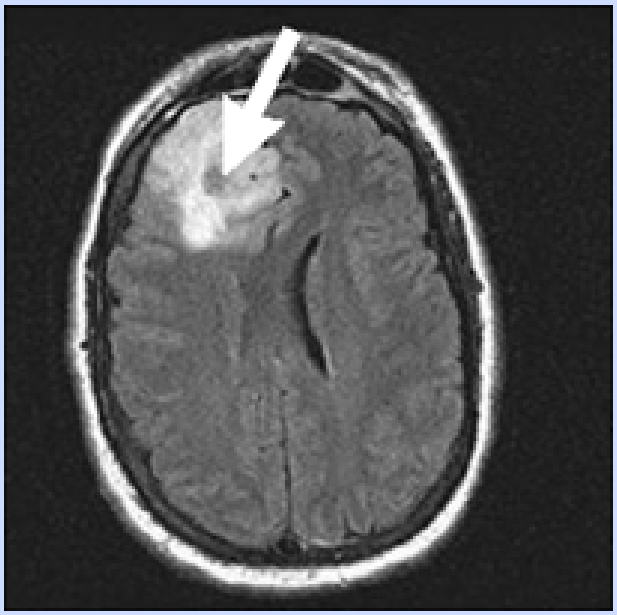

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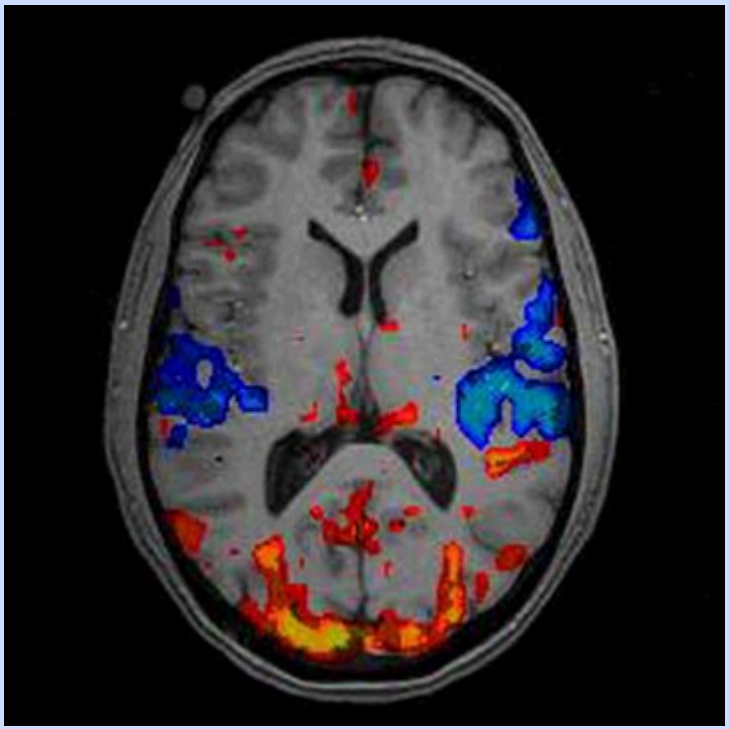

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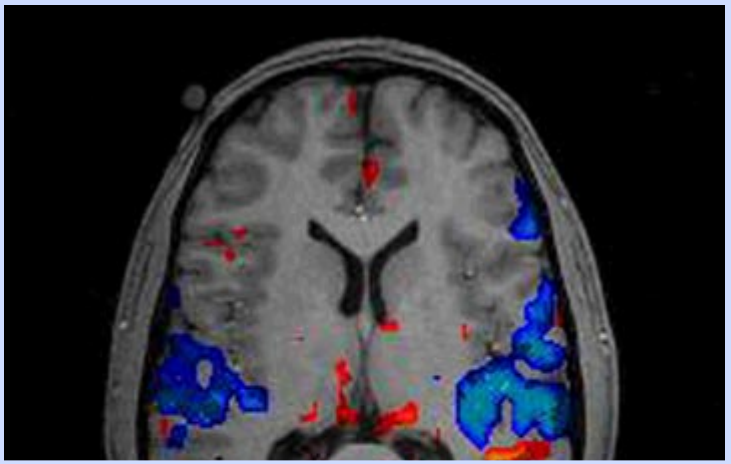
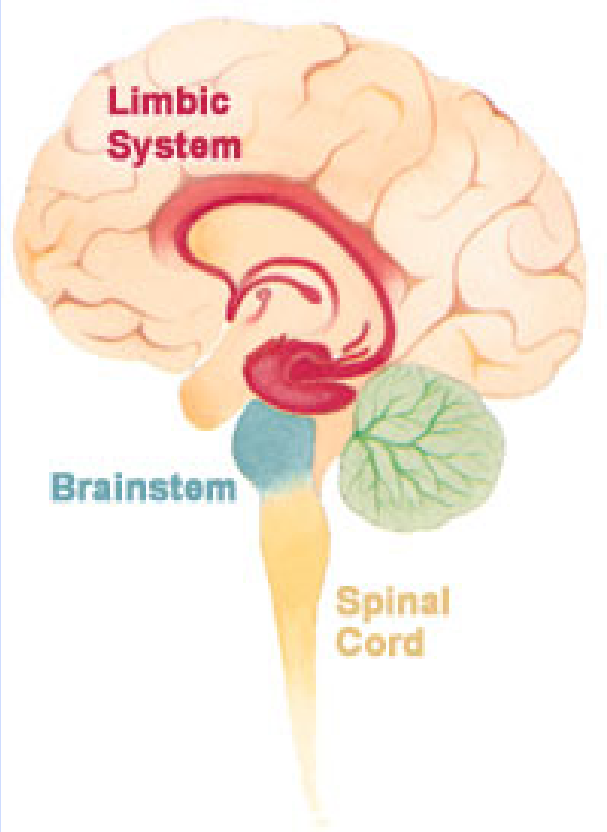


- Murphy, Nimmo-Smith and Lawrence (2003) "Functional neuroanatomy of emotions: A meta-analysis" → different neuroscientific models of emotion → testable predictions at the level of the brain

# Single-System Models of Emotion

## The limbic system theory of emotion

- a specialized system of brain structures mediates every variety of affect (MacLean, 1949, 1952, 1993, 2001)



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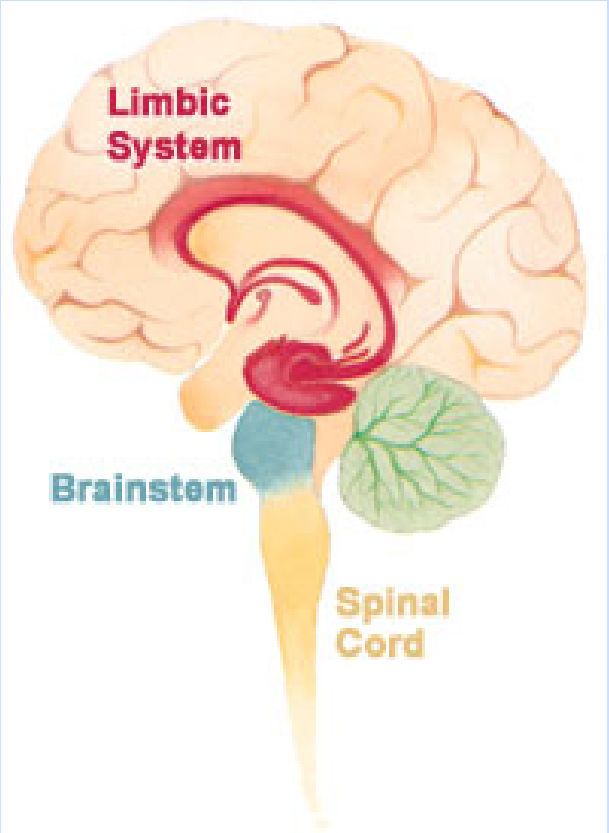

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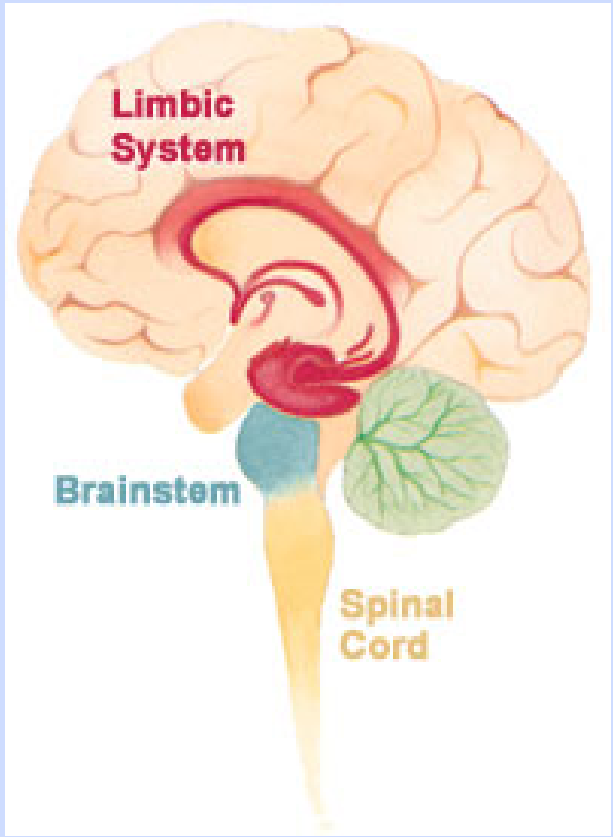
- the concept of a unitary system remains attractive to some researchers (Damasio, 1998; Panksepp, 2000)




→ Does this really help us to understand the complex phenomena we are investigating?

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**Alternative: the right-hemisphere (RH) hypothesis**

- highlights a critical role for the RH in all aspects of emotion processing (Mills, 1912; Sackeim & Gur, 1978; Schwartz, Davidson & Maer, 1975)
- **more recent variants**:
  - the RH is specifically involved in the perception and expression of emotion; special importance of posterior regions (Adolphs et al., 1996; Damasio, 1996; Borod et al., 1998; Borod et al., 2001; Heller, Nitschke & Miller, 1998)
  - the RH is specialized for processing highly arousing, unpleasant emotions, such as anger and fear (Adolphs, Russell & Tranel, 1999)

# Dual-System Models of Emotion

- new paradigms: conceptualising the neural bases of emotion more in terms of individual neural systems

  → **different functions concerning emotions are located in different parts of the brain!**

  → **categorical accounts**: a small set of discrete emotions is mediated by different central affect programs

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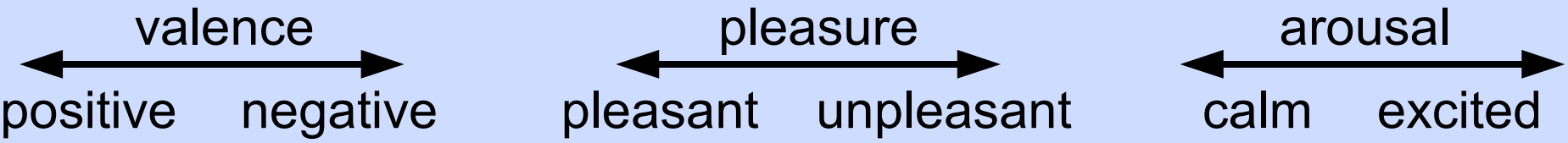


- and their neural bases are NOT found within one integrated system

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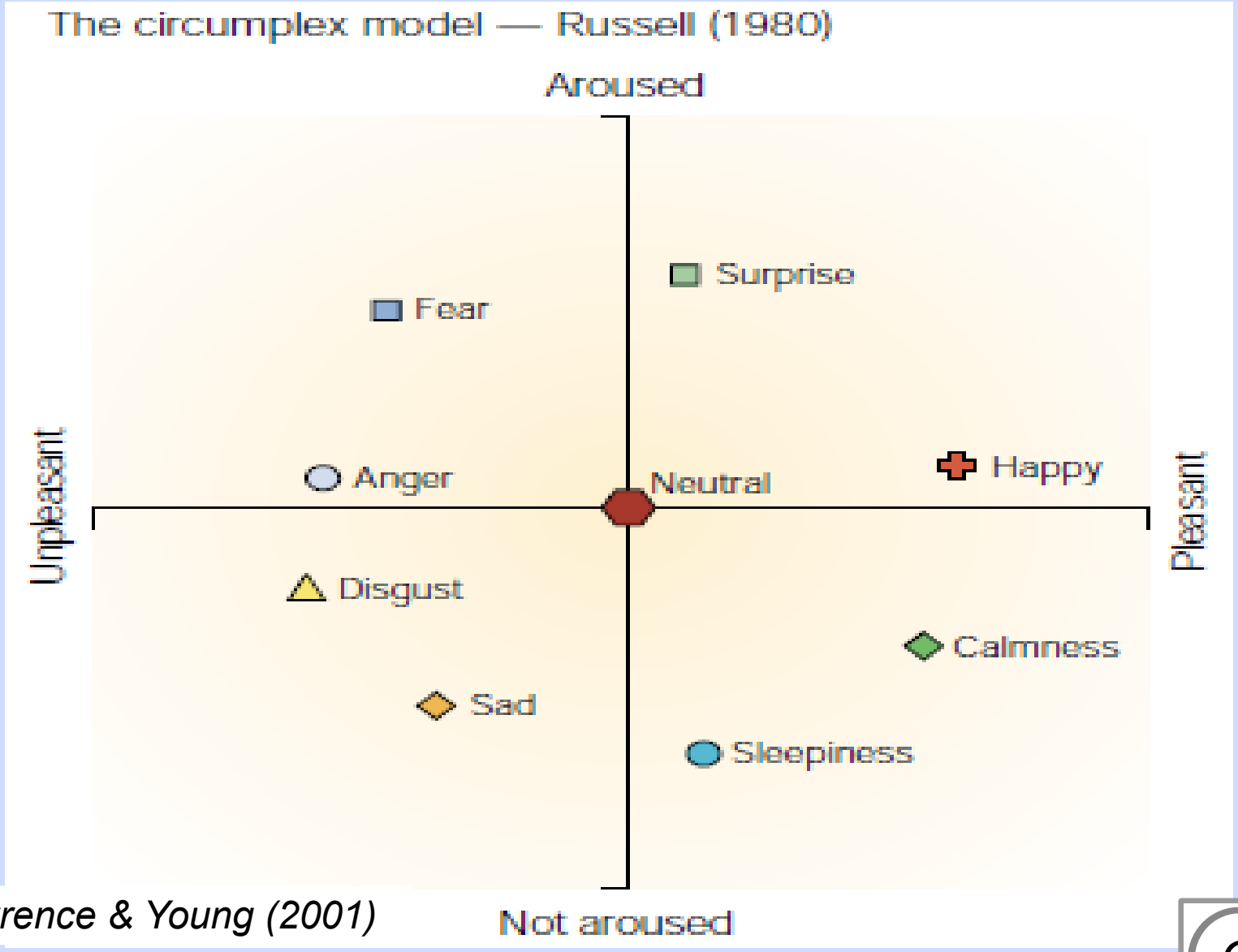


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- lesions to the amygdala → deficits in recognising facial expressions of fear & in fear responses
- lesions to the insula and the basal ganglia → deficits in recognising signals of disgust & in disgust responses

# Studies

Let's take a look at some studies...

| Studies | Participants | Stimuli |
|---|---|---|
| Phillips et al., 1997 | 7 healthy p. (2m, 5f) | faces with disgust, fear & neutral expressions |
| Phillips et al., 1998 | 6 healthy males | facial & vocal expressions of fear and disgust |
| Phillips et al., 2000 | 14 controls, 14 anxiety patients (7m, 7f each) | pictures displaying disgusting stimuli & neutral contents |
| Heining et al., 2003 | 2x8 healthy males | pleasant, unpleasant & disgusting odours, compared to fresh air |
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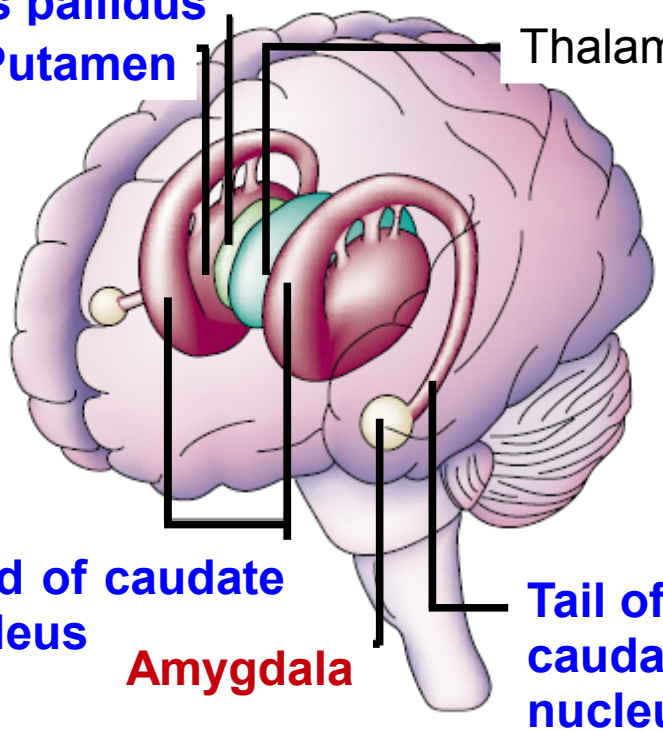
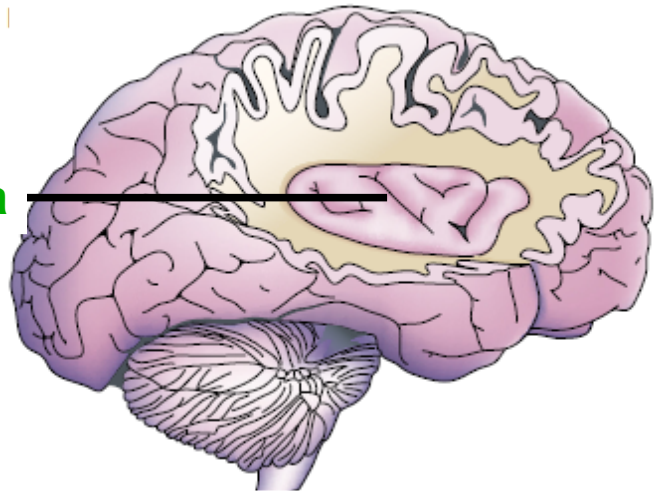
# Brainstructures

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Replications?

Converging evidence?

Disagreements?

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| Sprengelmeyer et al., 1997  | gender discr. faces: disgust, fear, anger | **F**: fusiform gyrus, dorsolateral and orbitofrontal cortex; **D**: insula, OFC, putamen |
| Schienle et al., 2002  | 120 scenes: disgust, fear neutral | **D**-ratings predict activation: insula, amygdala, OFC & occipito-temporal cortex; **F**: INSULA! |
| Schäfer et al., 2006  | 36 scenes, 36 faces: disgust, fear, neutral | **D**-scenes -event & -block: AMYGDALA, insula, OFC; **F**-scenes -event: INSULA, OFC, middle temporal gyri; -block: middle temporal gyri; **D**- & **F**-faces: NOTHING! Context? |
| Schienle et al., 2006  | 160 pictures: contamination & mutilation(D), fear, neutral | **D**: occipitotemporal cortex, AMYGDALA, OFC; mutilation induced greater inferior parietal activity than contamination scenes → network of brain regions? |
| Stark et al., 2007 ? | 50 scenes: disgust, fear neutral | **F** & **D**: extended occipital cortex, pfc, amygdala; insula only significantly correlated with ratings of **disgust** |

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  → function-location meta-analysis of data from 106 neuroimaging studies of emotion processing (62 PET and 44 fMRI) in healthy volunteers

  → the location, rather than the magnitude, of the effect is of interest

# Function-location Meta-analysis: Results I

limbic system model & RH hypothesis does not receive support

- widespread pattern of neural activity; many non-limbic areas activated
- all studies: ~ equivalent numbers of left- and right-sided maxima
- studies of the perception of emotion (faces) or the processing of highly arousing, unpleasant emotions (withdrawal): just the same

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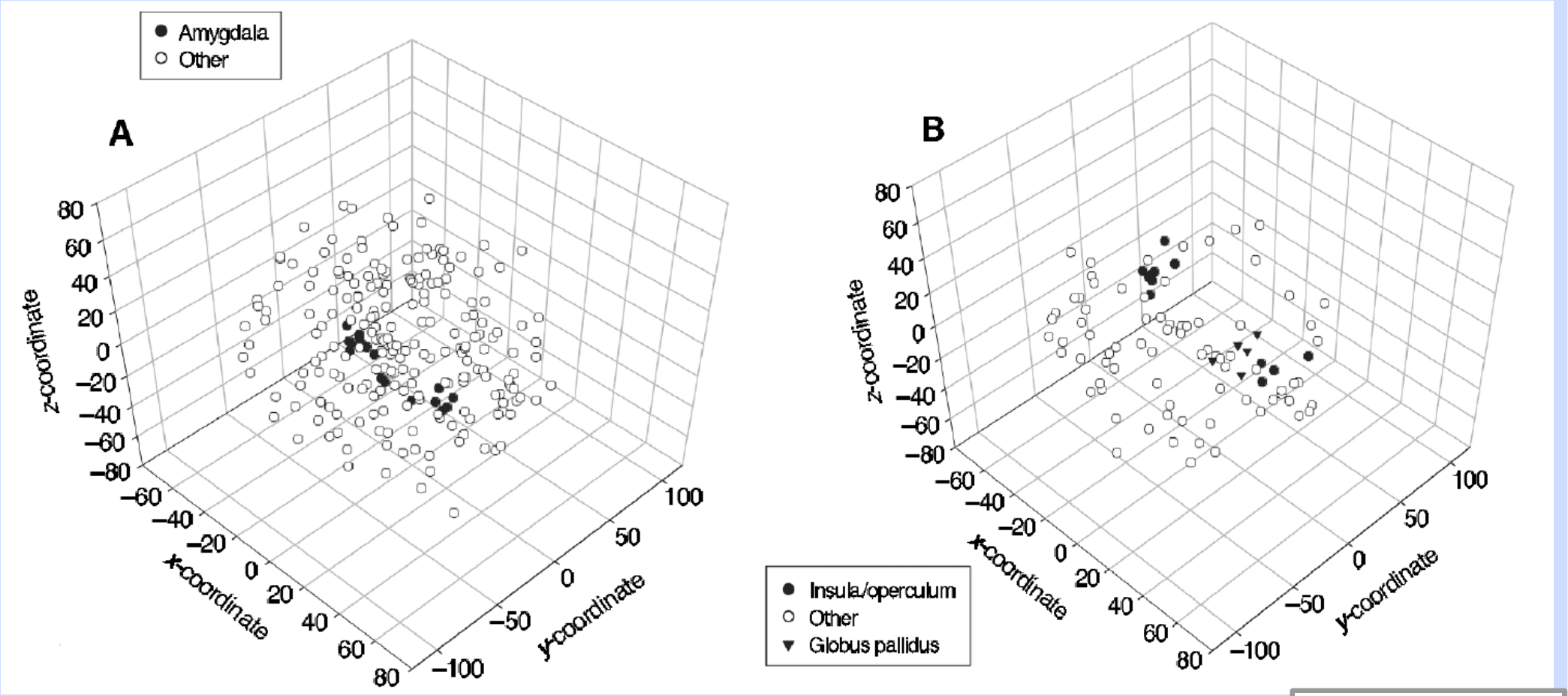
the approach-withdrawal model receives partial support

- LH > RH activity for approach-related emotions; symmetrical activity for withdrawal-related emotions not restricted to anterior regions
- numbers of left- and right-sided peak maxima did not differ for withdrawal-related emotions nor did they vary as a function of anterior-posterior regions

# Results II: Distributions of Activation Foci

- 3D scatter plots showing distributions of activation foci (MNI coordinates) for contrasts associated with (A) fear and (B) disgust. Filled symbols represent activations in regions most frequently associated with each particular emotion across studies.



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- brain regions reported as significantly active in the largest proportion of studies for...
  - **fear**: amygdala – 10/26 fear studies, < 20% of the other studies
  - **disgust**: insula – 5/7 disgust studies, < 40% of the other studies; globus pallidus – 5/7, < 25% of the other studie

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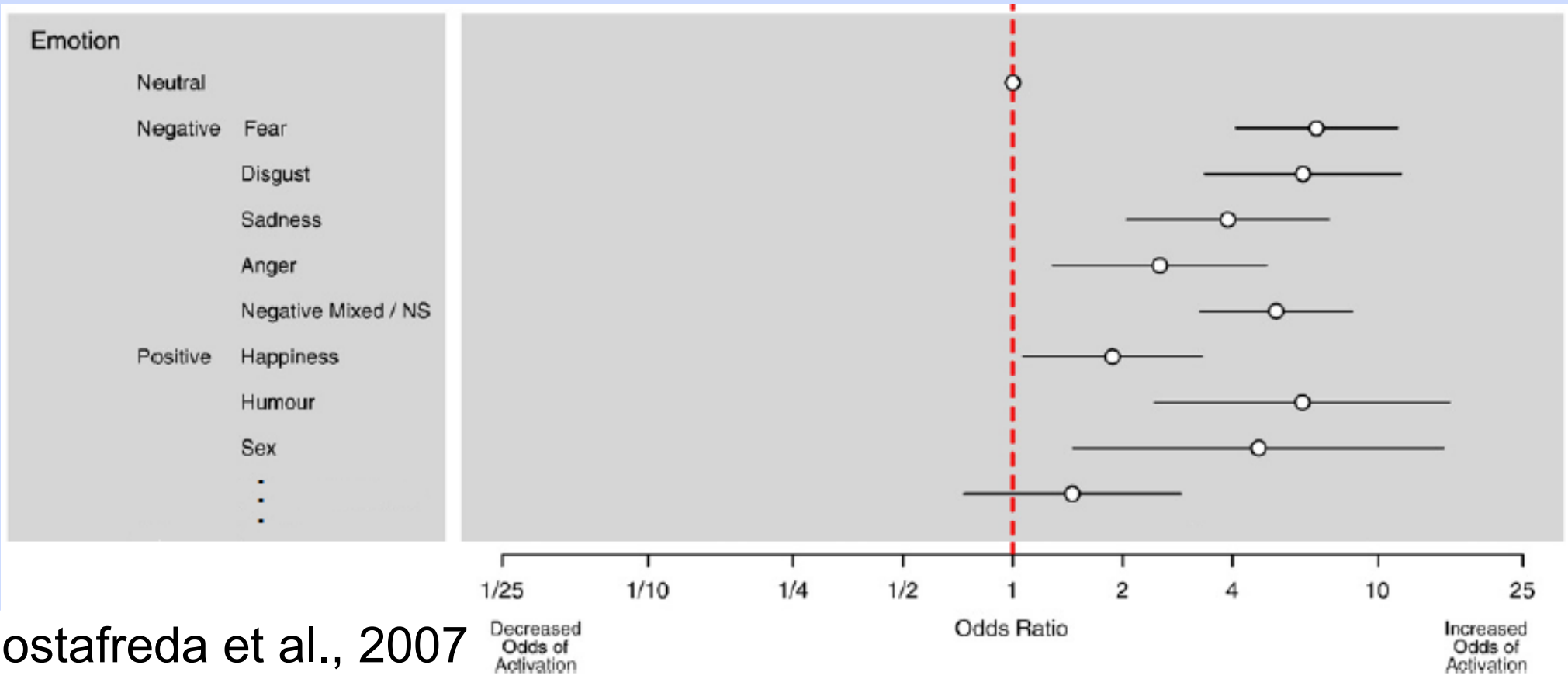
  - **disgust**: insula – 5/7 disgust studies, < 40% of the other studies; globus pallidus – 5/7, < 25% of the other studies
- when only looking at studies employing facial expressions...
  - **fear**: amygdala – 5/8
  - **disgust**: – insula (5/5); globus pallidus – 4/5

# Results II: Affect Program Emotions

- distributions for **fear** vs. **disgust**, anger & sadness differ significantly; distributions for **disgust** vs. anger, happiness & sadness differ significantly, too → **regional specialization of fear and disgust**
- brain regions reported as significantly active in the largest proportion of studies for...
  - **fear**: amygdala – 10/26 fear studies, < 20% of the other studies
  - **disgust**: insula – 5/7 disgust studies, < 40% of the other studies; globus pallidus – 5/7, < 25% of the other studies
- when only looking at studies employing facial expressions...
  - **fear**: amygdala – 5/8
  - **disgust**: – insula (5/5); globus pallidus – 4/5
- findings mirror quite closely those from neuropsychological studies (lesions or diseases, e.g. Huntington's disease)

# Concluding Remarks

Murphy et al. (2003) “think that the imaging data, together with neuropsychological evidence, suggest the existence of particular emotion systems – systems that are isolable, specialized, and internally cohesive and that are involved in (but not necessarily exclusively dedicated to) fear, disgust, [and anger].”




Costafreda et al., 2007

# The Next Steps

- review more meta-analyses (meta-meta-analysis...?)
- compare to EEG findings

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- review more meta-analyses (meta-meta-analysis...?)
- compare to EEG findings
- maybe develop some own ideas

# To be continued...