Bildgebung bei Bipolarer Störung

- Zur Differenzierung zwischen unipolarer und bipolarer Depression -

Ronny Redlich, Katharina Dohm, Dario Zaremba, Nils Opel, Dominik Grotegerd, Udo Dannlowski

Ziele & Bedeutung

- **Bedeutung**: Diagnosestellung schwierig
  - Häufige Fehldiagnosen
  - Fehlbehandlung
  - schlechtere Prognose
  - Höhere Kosten für das soziale (Gesundheits-) System
- **Ziele:**
  - Grundlagen-Forschung und Biomarker (Funktion und Struktur)
  - Prädiktion der Diagnose, bzw. Support bei der Diagnosestellung
- **Die Frage ist…**



Emotionsverarbeitung – Paradigma Supraliminal

- **Stichprobe:**
  - Bipolare Depression (n = 10)
  - Unipolare Depression (n = 10)
  - Kontrollgruppe (n = 10)
- **Funktionelles Paradigma:**
  - Supraliminaler Face-Processing-Task
- **Bedingungen:**
  - Positiver Ausdruck
  - Negativer Ausdruck
  - Neutraler Ausdruck

Grotegerd et al. 2013 (Europ. Arch. Psychiatry)

Emotionsverarbeitung - Supraliminal

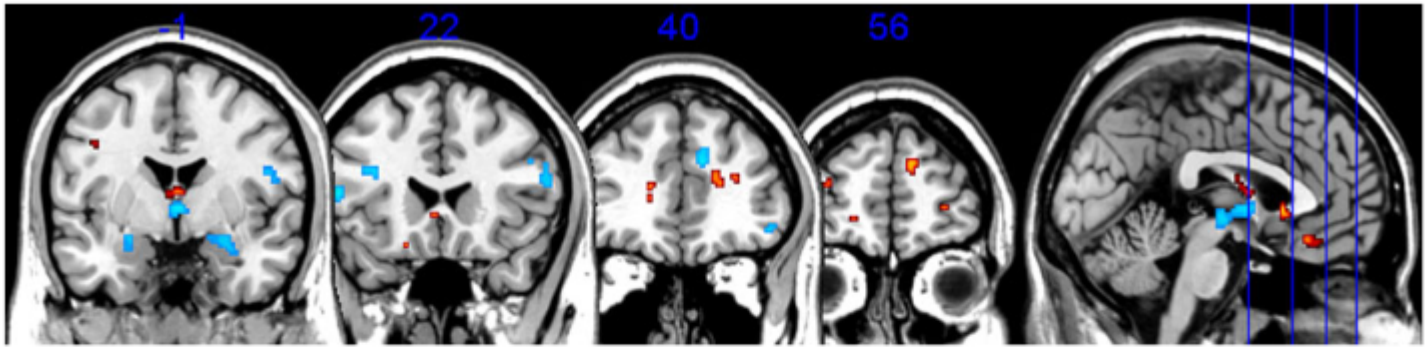


Fig. 2 Discriminative map for SVM classifier "happy versus neutral" (trained by leaving out subject 3). All voxels with values lower than half of the maximum value were removed. Only clusters with at least 20 voxels are shown. *Blue* voxels correspond to higher activations in the group of bipolar depressive subjects, while *red* corresponds to the unipolar depressive subjects

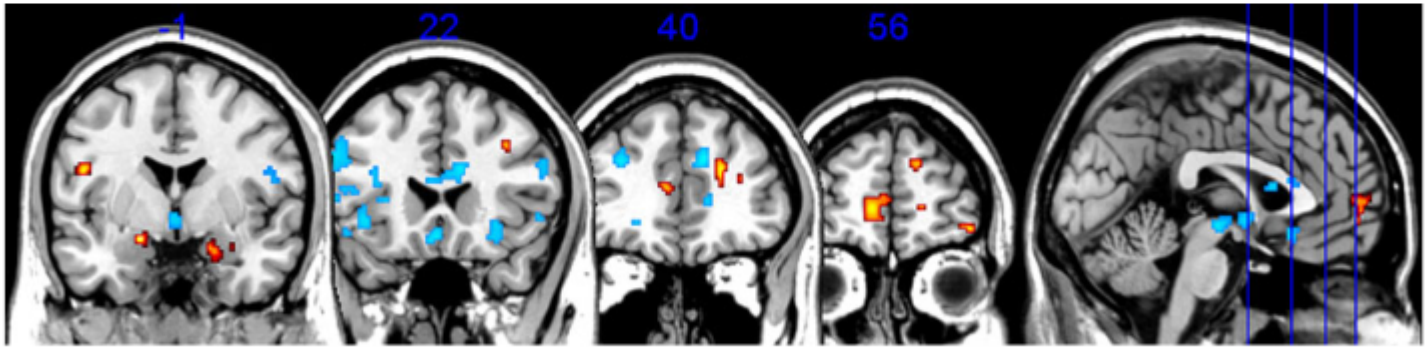


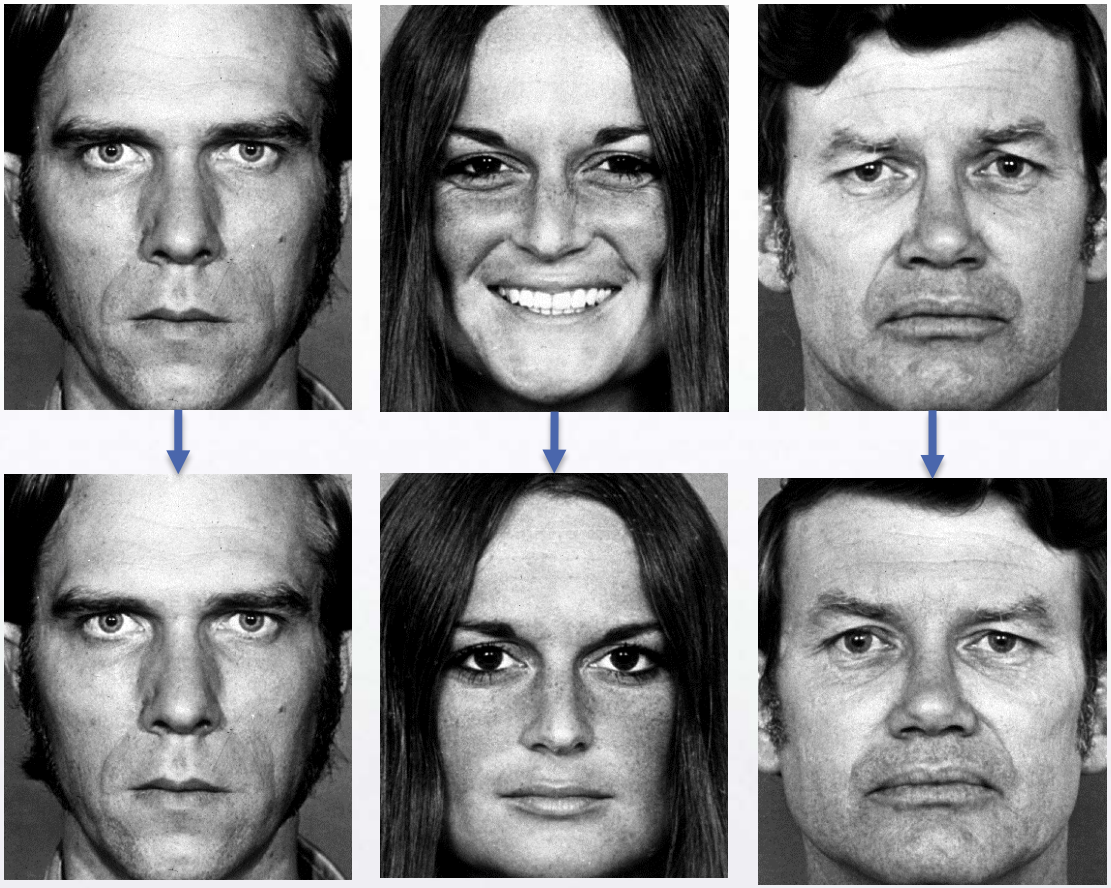
Fig. 3 Discriminative map for SVM classifier "negative versus neutral" (trained by leaving out subject 3). Voxels with values lower than half of the maximum value were removed, only clusters with 20 or more of the remaining voxels are shown. *Blue* voxels correspond to higher activations in the group of bipolar depressive subjects, while *red* corresponds to the unipolar depressive subjects

Grotegerd et al. 2013 (Europ. Arch. Psychiatry)

Emotionsverarbeitung – Paradigma Subliminal

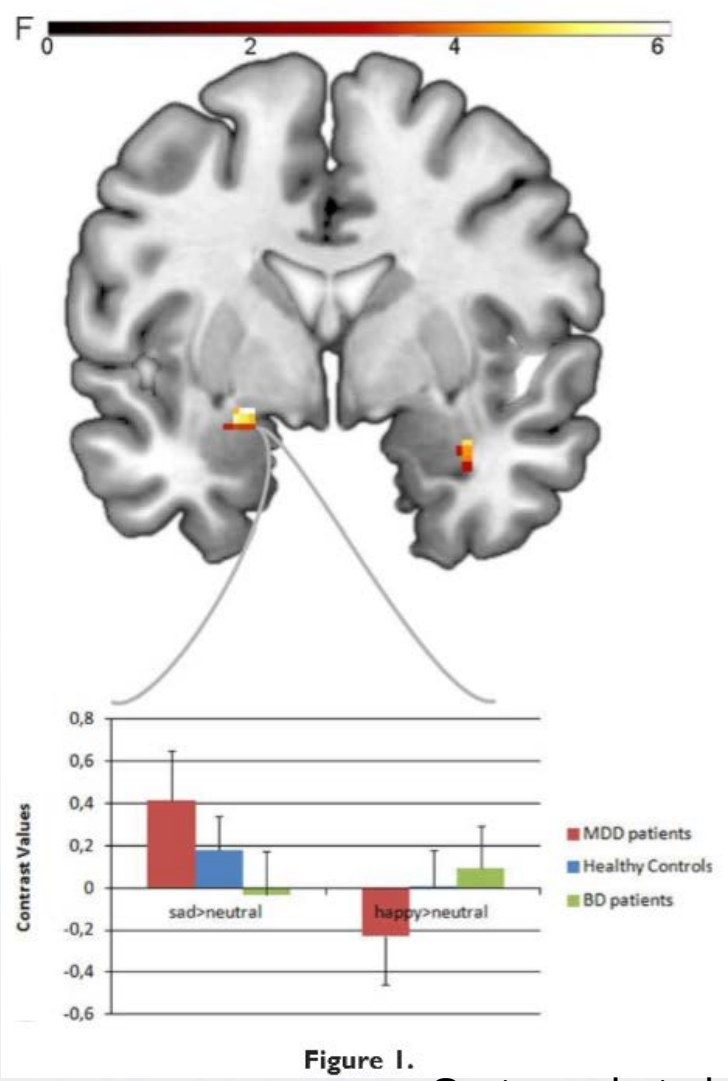
- **Stichprobe:**
  - Bipolare Depression (n = 22)
  - Unipolare Depression (n = 22)
  - Kontrollgruppe (n = 22)
- **Funktionelles Paradigma:**
  - Subliminaler Face-Processing-Task
- **Bedingungen:**
  - Positiver Prime
  - Negativer Prime
  - Neutrale Prime

Prime 33 ms!



Grotegerd et al. 2014 (Human Brain Mapping)

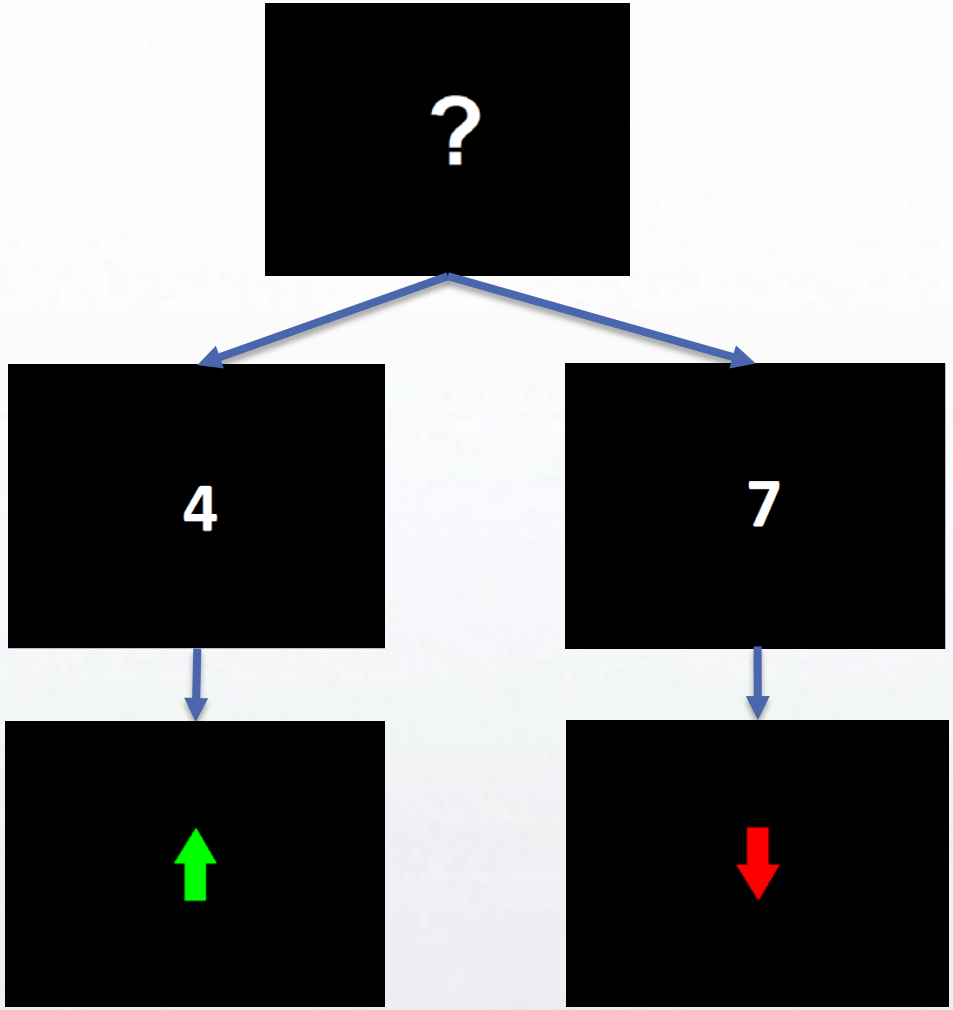
Emotionsverarbeitung - Subliminal



Grotegerd et al. 2014 (Human Brain Mapping)

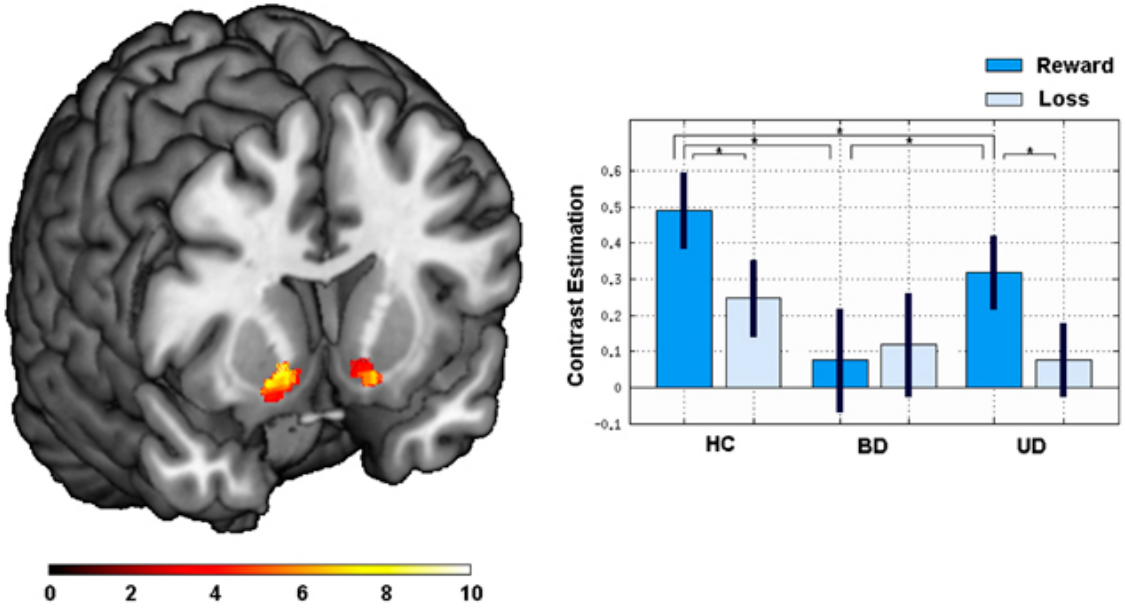
Belohnungsprozesse - Paradigma

- **Stichprobe:**
  - Bipolare Depression (n = 33)
  - Unipolare Depression (n = 33)
  - Kontrollgruppe (n = 34)
- **Funktionelles Paradigma:**
  - Kartenrate-Aufgabe
- **Bedingungen:**
  - Gewinn
  - Verlust
  - Kontrolle



Redlich et al. 2015 (Neuropsychopharmacology)

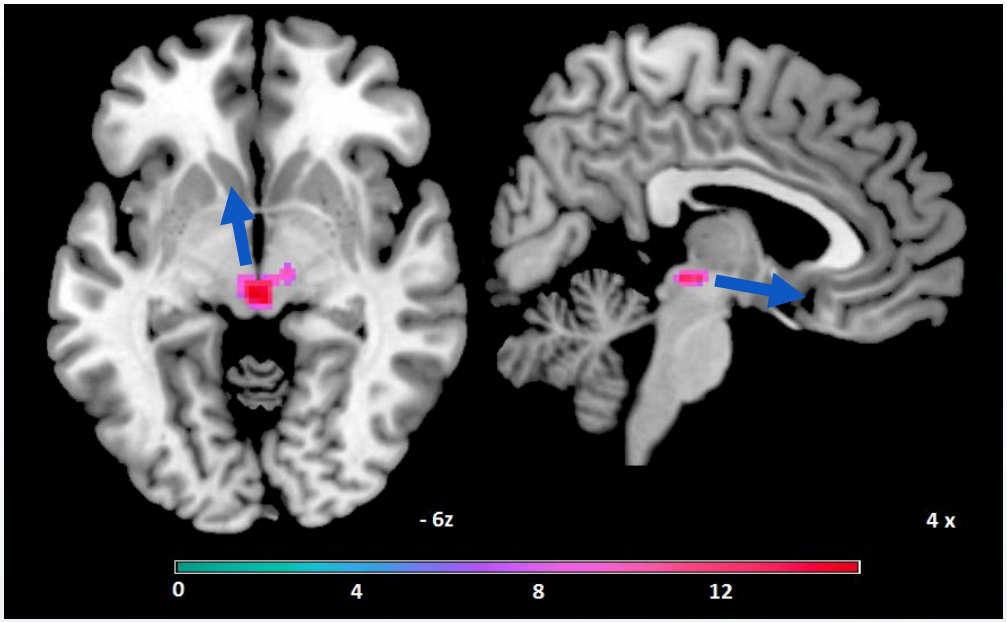
Belohnungsprozesse – Nucleus Accumbens

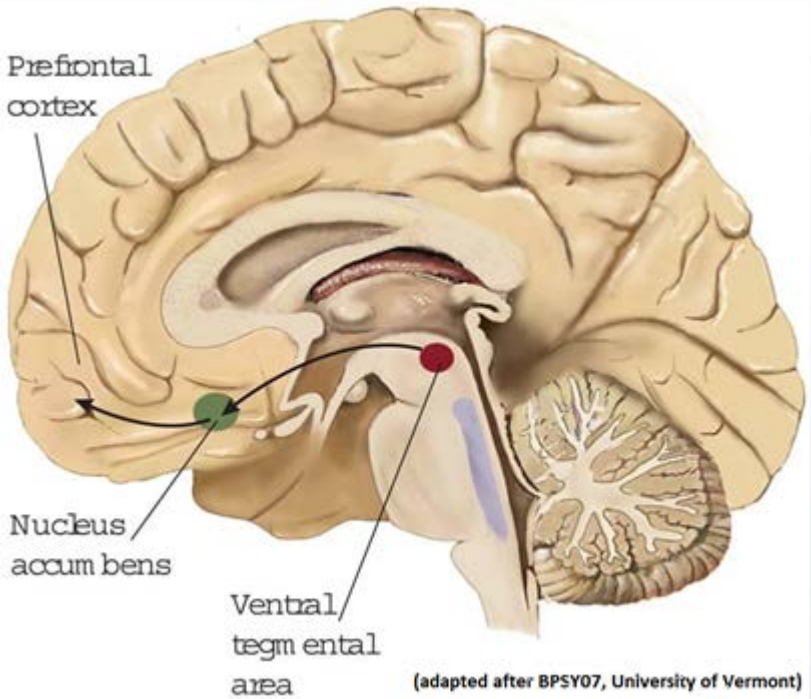


Left: Coronal slice (MNI coordinates at y=−4) depicting the results of the 2 × 3 ANOVA interaction within the NAcc. Color bar: F-value. Right: The bars depicting the estimated contrast values for healthy controls (HCs), bipolar disorder (BD), and unipolar depression (UD) for the reward>control (dark blue) and loss>control (light blue) condition. Asterisks indicate significant differences corrected using AlphaSim (voxel threshold, P<0.05; minimum cluster volume threshold k=14 voxels). MNI, Montreal Neurological Institute.

Redlich et al. 2015 (Neuropsychopharmacology)

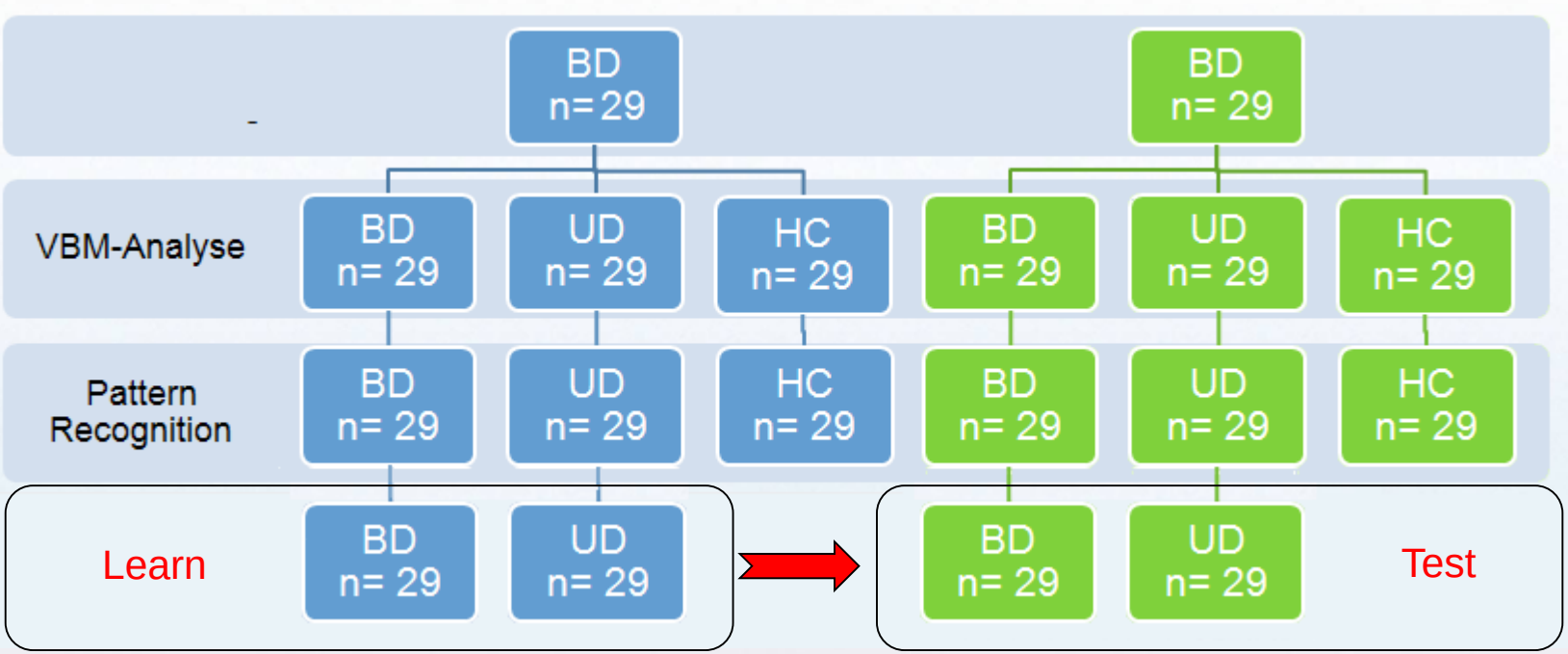
Belohnungsprozesse – Funktionelle Konnektivität





Redlich et al. 2015 (Neuropsychopharmacology)

Struktur - Design

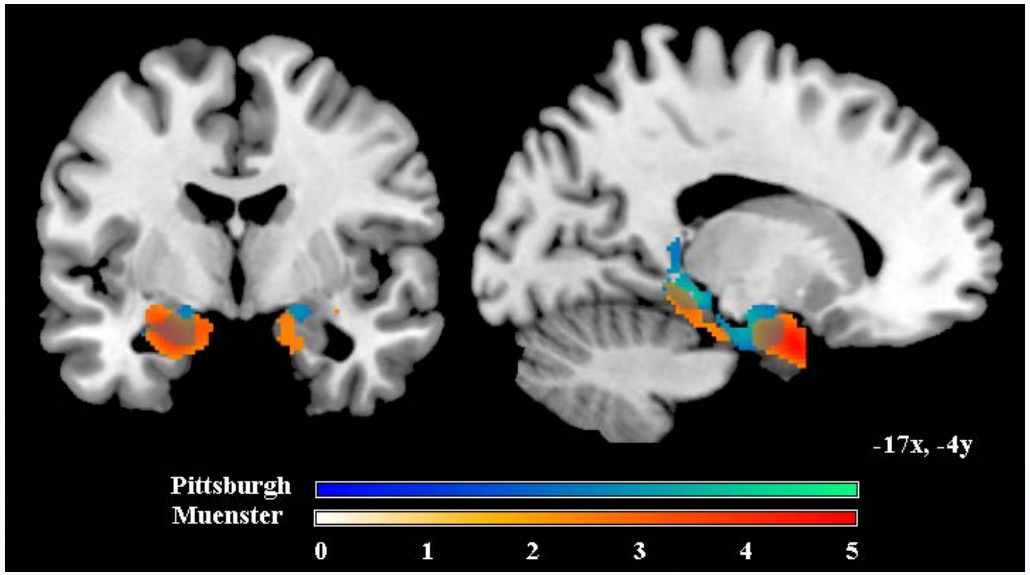


Redlich et al. 2014 (JAMA Psychiatry)

Struktur - Ergebnisse

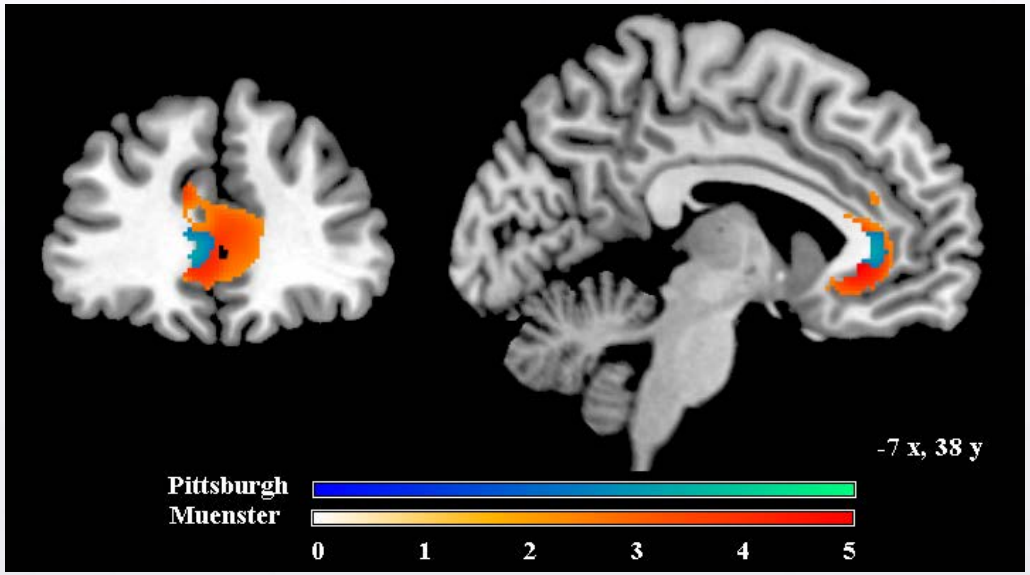
Unipolar > Bipolar

- Hippocampus
- Amygdala

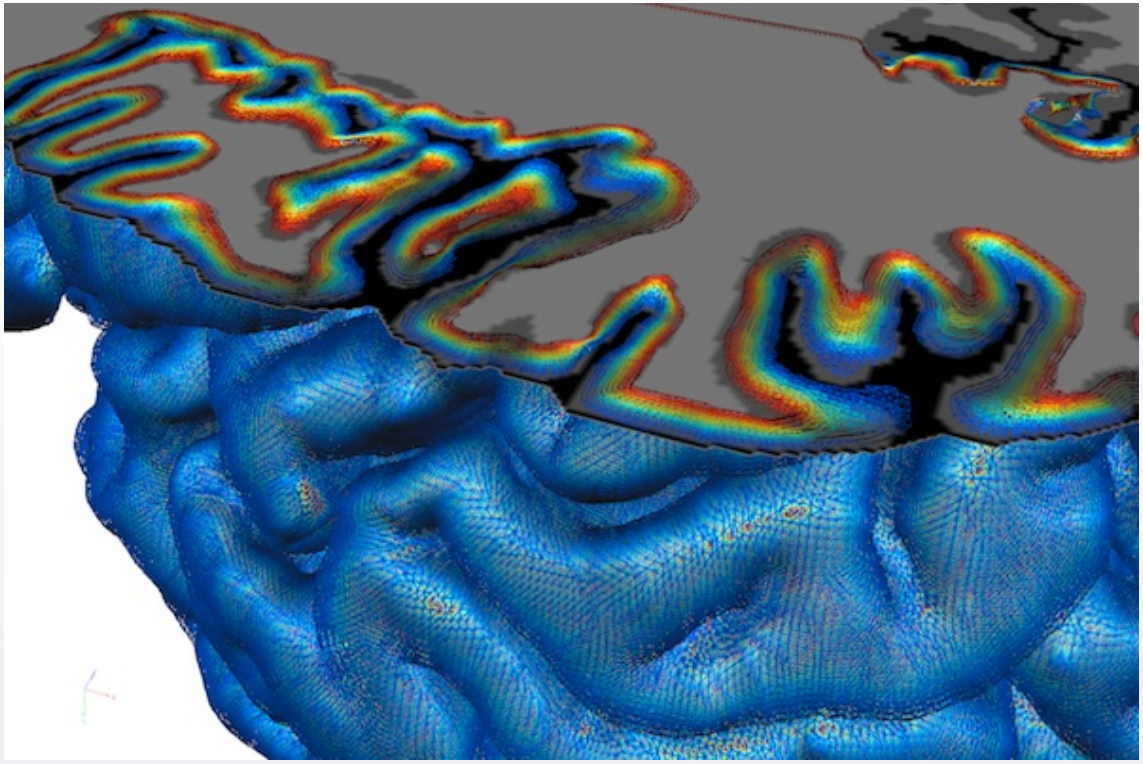


Bipolar > Unipolar

- Anteriores Cingulum



Mustererkennung



Mustererkennung - Stand

Eur Arch Psychiatry Clin Neurosci
DOI 10.1007/s00406-012-0329-4

ORIGINAL PAPER

ORIGINAL ARTICLES

Pattern Classification of Sad Facial Processing: Toward the Development of Neurobiological Markers in Depression

Cynthia H.Y. Fu, Janaina Mourao-Miranda, Sergi G. Costafreda, Akash Khanna, Andre F. Marquand, Steve C.R. Williams, and Michael J. Brammer

Discriminating unipolar and bipolar depression by means of fMRI and pattern classification: a pilot study

Dominik Grotegerd · Thomas Suslow · Jochen Bauer · Patricia Ohrmann · Volker Arolt · Anja Stuhrmann · Walter Heindel · Harald Kugel · Udo Dannlowski

Pattern recognition analyses of brain activation elicited by happy and neutral faces in unipolar and bipolar depression

Mourão-Miranda J, Almeida JRC, Hassel S, de Oliveira L, Versace A, Marquand AF, Sato JR, Brammer M, Phillips ML. Pattern recognition analyses of brain activation elicited by happy and neutral faces in unipolar and bipolar depression.
Bipolar Disord 2012: 14: 451–460.

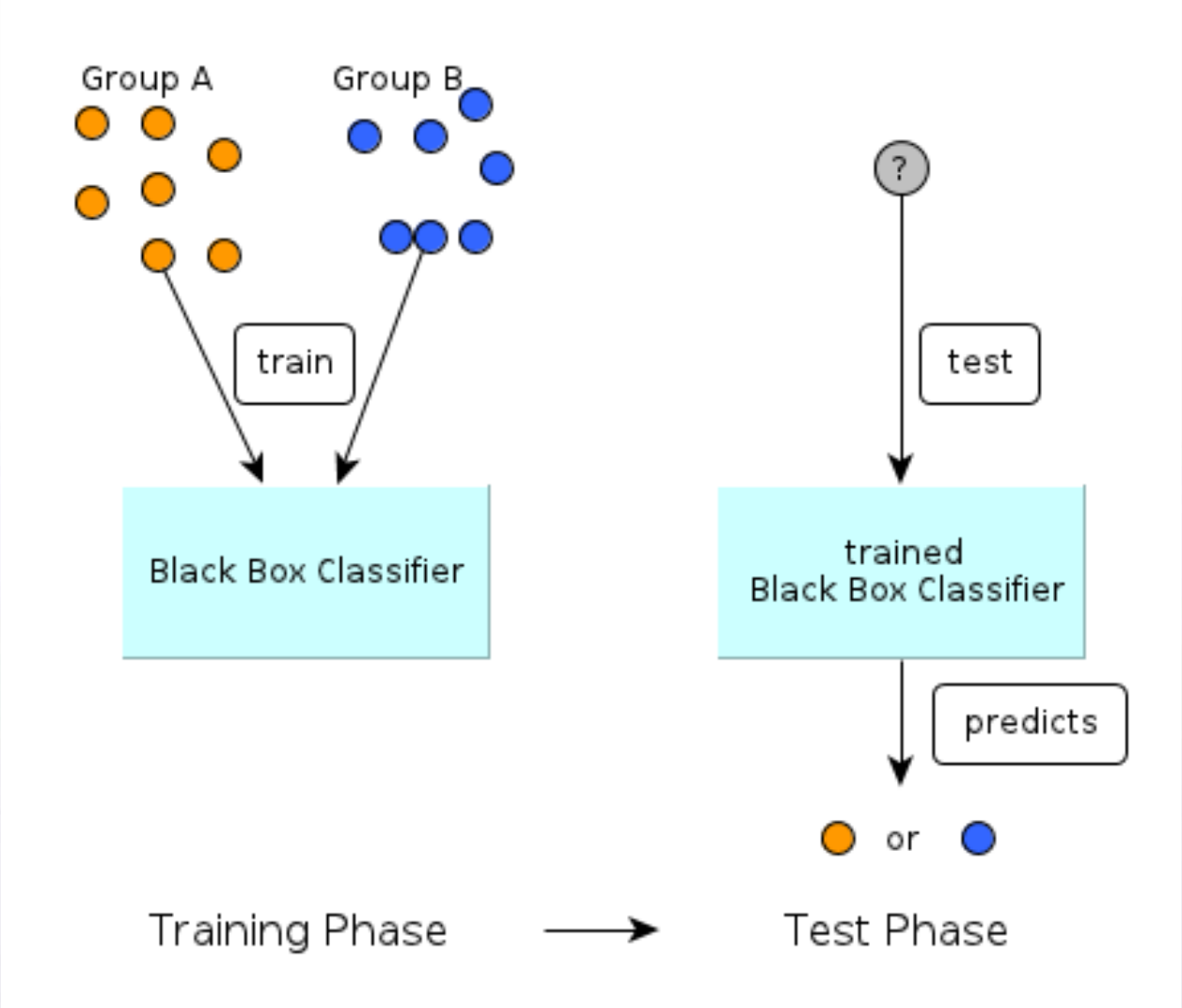
Janaina Mourão-Miranda[a,b], Jorge RC Almeida[c], Stefanie Hassel[e], Leticia de Oliveira[b,d], Amelia Versace[e], Andre F Marquand[b], Joao R Sato[a], Michael Brammer[f] and Mary L Phillips[c,g]

• Human Brain Mapping 35:2995–3007 (2014) •

Amygdala Excitability to Subliminally Presented Emotional Faces Distinguishes Unipolar and Bipolar Depression: An fMRI and Pattern Classification Study

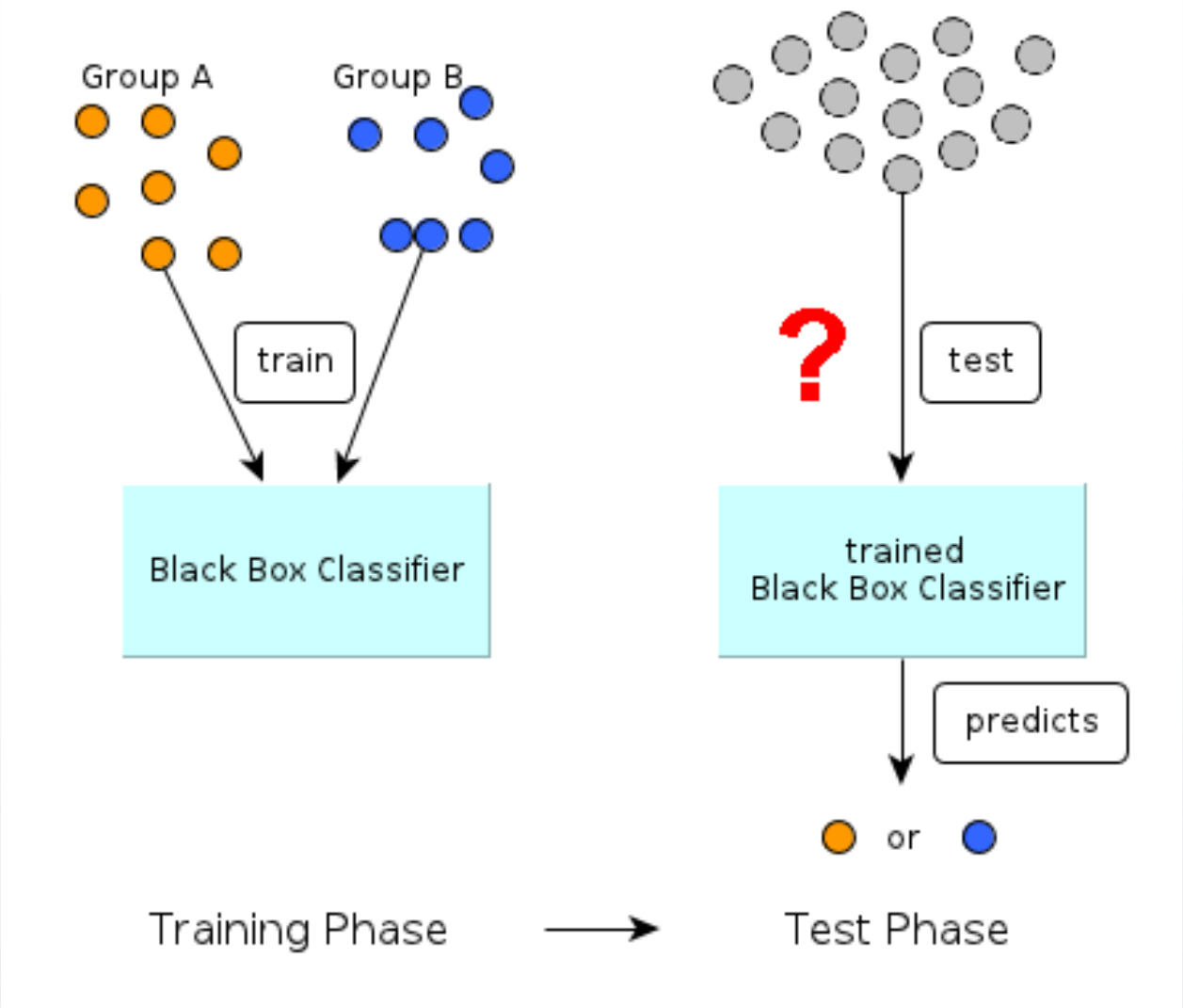
Dominik Grotegerd,[1] Anja Stuhrmann,[1] Harald Kugel,[2] Simone Schmidt,[1] Ronny Redlich,[1] Peter Zwanzger,[1] Astrid Veronika Rauch,[1] Walter Heindel,[2] Pienie Zwitserlood,[3] Volker Arolt,[1] Thomas Suslow,[1,4] and Udo Dannlowski[1,5*]

Mustererkennung - Methode



Redlich et al. 2014 (JAMA Psychiatry)

Mustererkennung – Transfer über Samples



Redlich et al. 2014 (JAMA Psychiatry)

Mustererkennung – Transfer über Samples

Table 3. Results of the Pattern Classification Analyses[a]

Model and Method	Accuracy, %	Sensitivity,[b] %	Specificity,[c] %	*P* Value
Cross-validation Münster sample (n = 58)				
SVM	75.9	75.9	75.9	<.001
GPC	79.3	75.9	82.8	<.001
Cross-validation Pittsburgh sample (n = 58)				
SVM	65.5	65.5	65.5	.006
GPC	65.5	65.5	65.5	.006
Train (Münster) and test (Pittsburgh) (n = 116)				
SVM	63.8	69.0	58.6	.01
GPC	62.1	65.5	58.6	.02
Train (Pittsburgh) and test (Münster) (n = 116)				
SVM	69.0	75.9	62.1	.001
GPC	69.0	65.5	72.4	.001

Redlich et al. 2014 (JAMA Psychiatry)

Zusammenfassung und Ausblick

- **Biomarker:**
  - Strukturell: ACC; Amygdala, Hippocampus
  - Emotionsverarbeitung: Limbisches System (insb. Amygdala)
  - Belohnungsprozesse: Mesolimbisches System (inkl. Ventrales Striatum)
- **Prädiktion:** Mustererkennungsverfahren sind bereits (statistisch) fähig die Gruppen überzufällig zu klassifizieren, sowohl funktional als auch strukturell, auch an unterschiedlichen Samples
- **Ausblick:** Bildgebung und Mustererkennungs-verfahren als klinischen Support denkbar

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Münster

UPMC | University of Pittsburgh Medical Center

Vielen Dank!

UKM