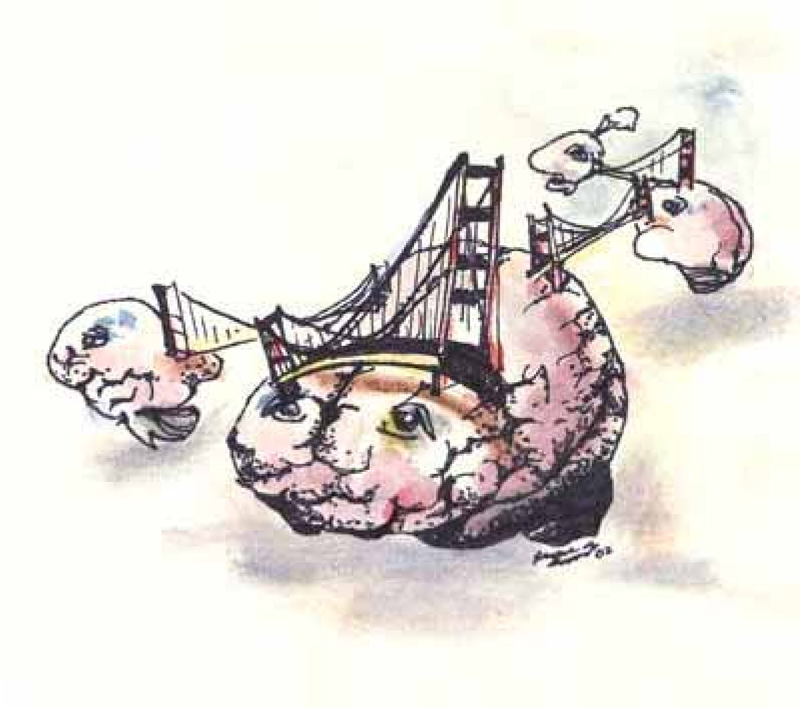
The social brain

Interaktion & Kommunikation

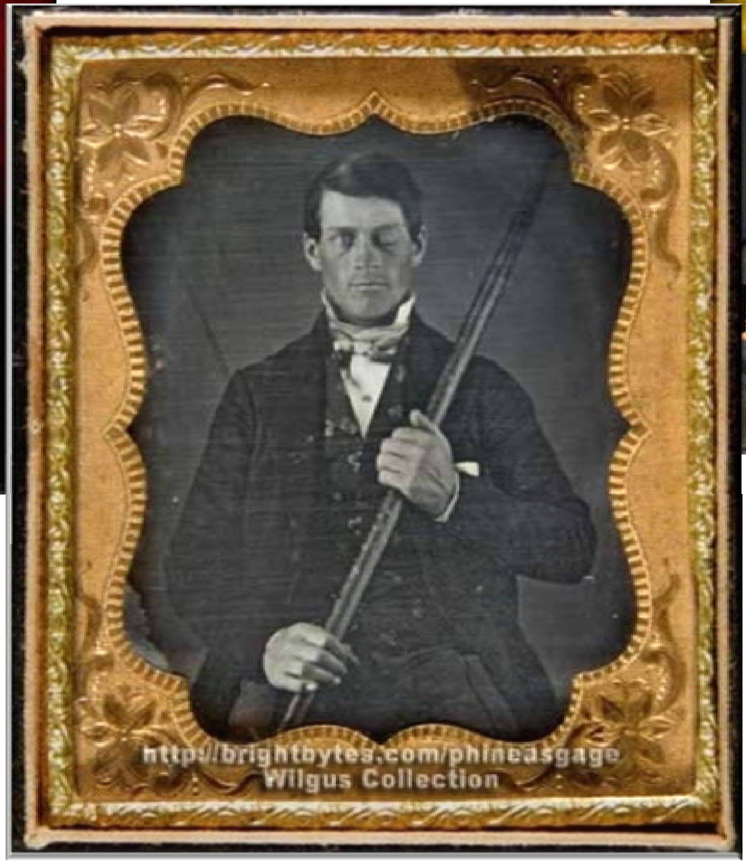
Überwachen & Kontrolle von Verhalten

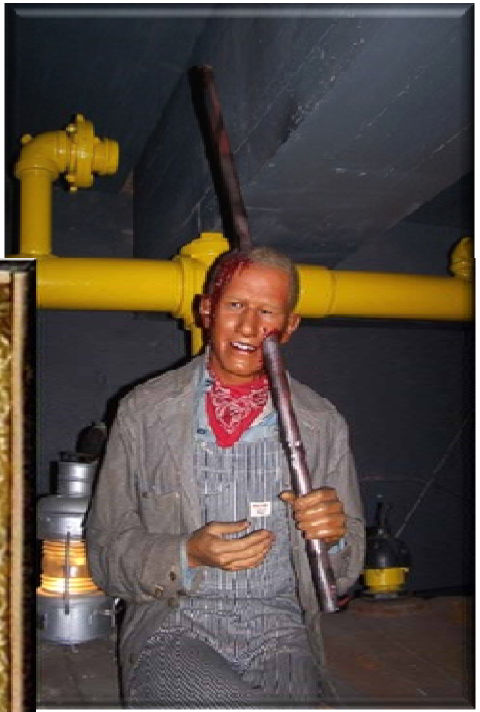
Gedächtnis

Soziale Kognition

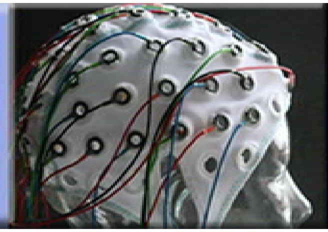


Phineas Gage





Zwei Gehirnstrukturen für Emotionsverarbeitung



Der orbitofrontale Cortex und die Amygdala

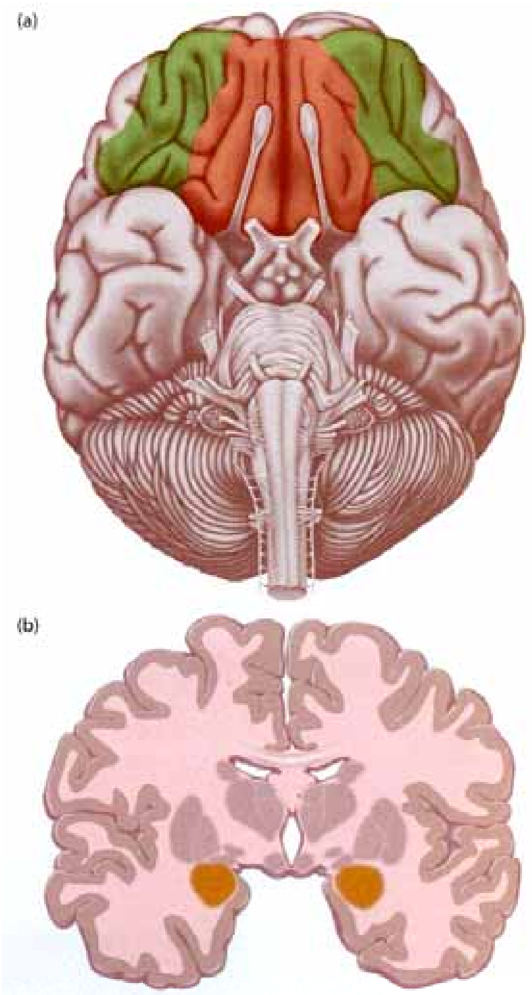


Figure 13.5 **(a)** The human orbitofrontal cortex, which is often divided into the ventromedial prefrontal cortex (red) and the lateral orbitofrontal cortex (green). **(b)** The human amygdala is highlighted in orange. From Davidson et al. (2000).

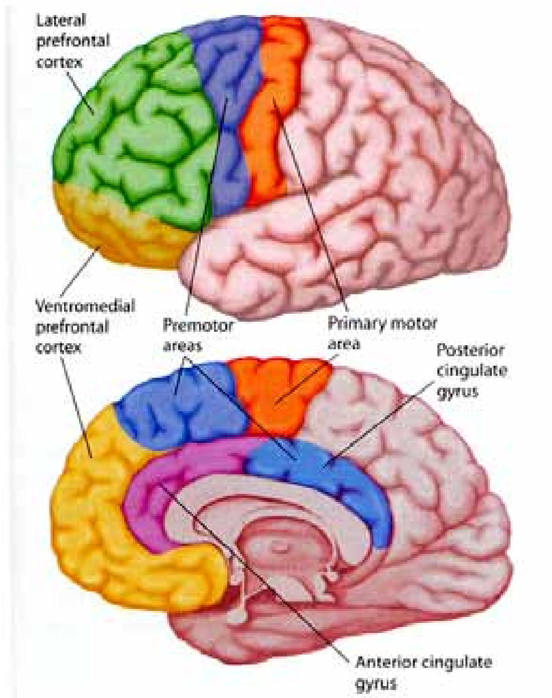
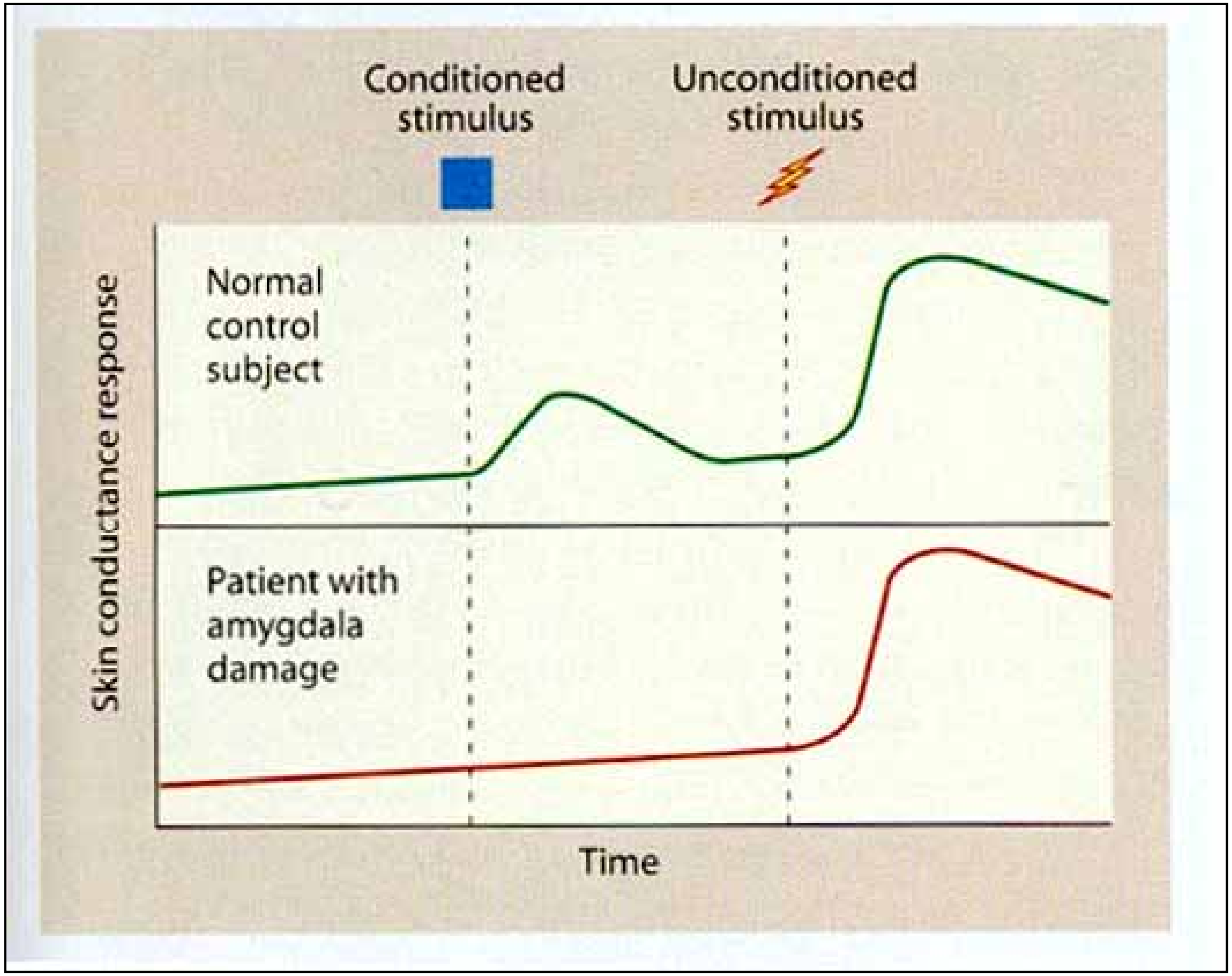


Figure 12.1 The areas of the frontal lobe. The prefrontal cortex includes all of the areas in front of the primary and secondary motor regions. The three major subdivisions of prefrontal cortex are the lateral prefrontal, ventromedial prefrontal, and the anterior cingulate cortex.

Auswirkung der Amygdalektomie auf Angstkonditionierung



Entscheidungsverhalten nach orbitalen PFC Läsionen

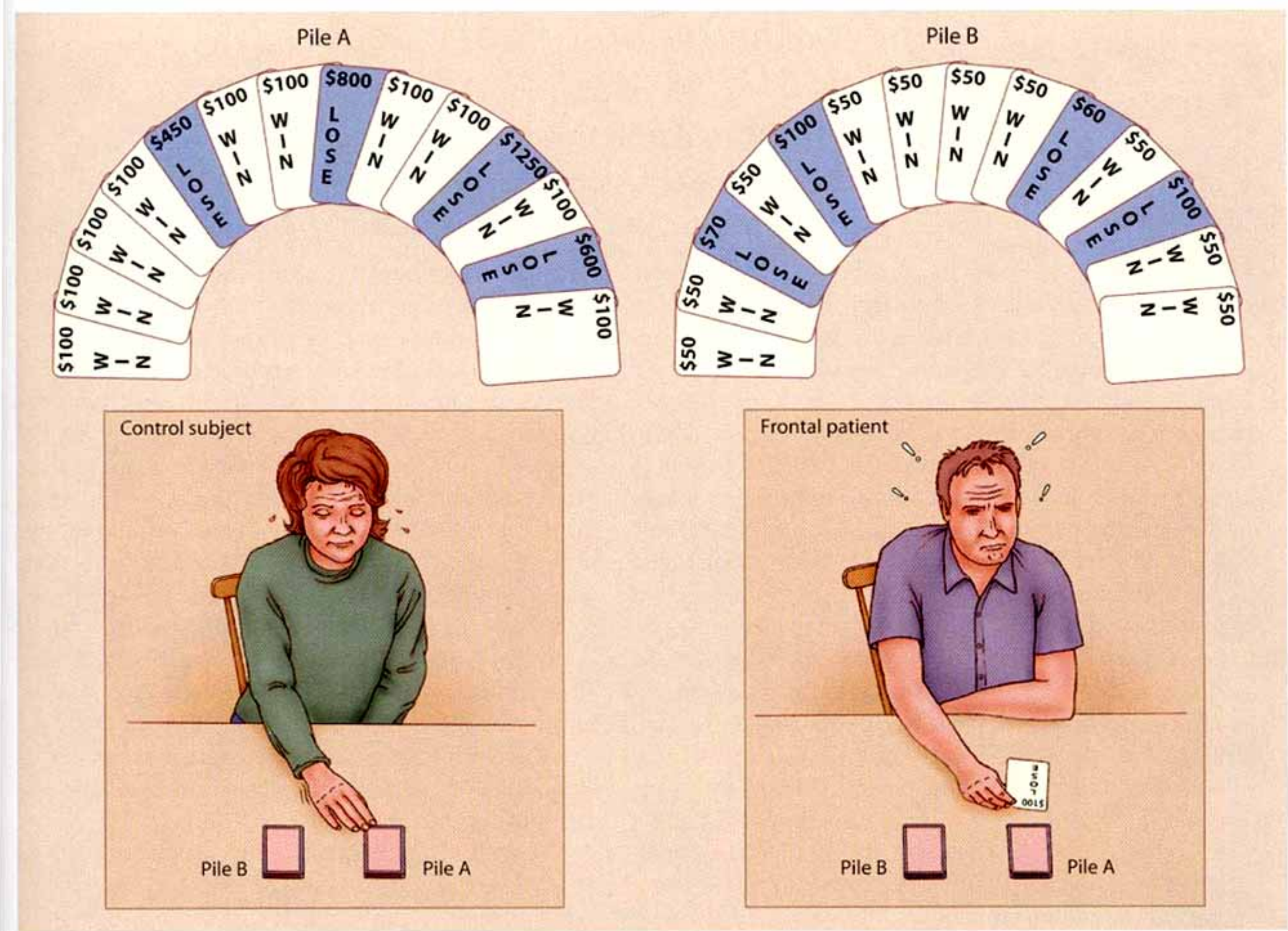
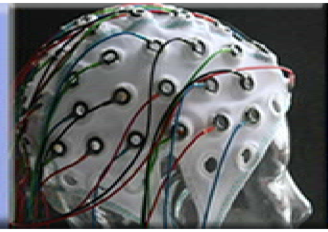


Figure 13.9 Emotional responses occur in reaction to stimuli but also are useful in guiding our decision processes. Subjects were required to choose cards from one pile or the other, with each card specifying an amount won or lost. Through trial and error, the subjects could learn that pile A was riskier than pile B. Control subjects not only tended to avoid the high-risk pile but also showed a large SCR when considering choosing a card from this pile. The patients with prefrontal lesions failed to show these anticipatory SCRs. Interestingly, they did show a large SCR upon turning over a card and discovering they had lost $1000 (of play money).

→ Schmeckt gut = Belohnung



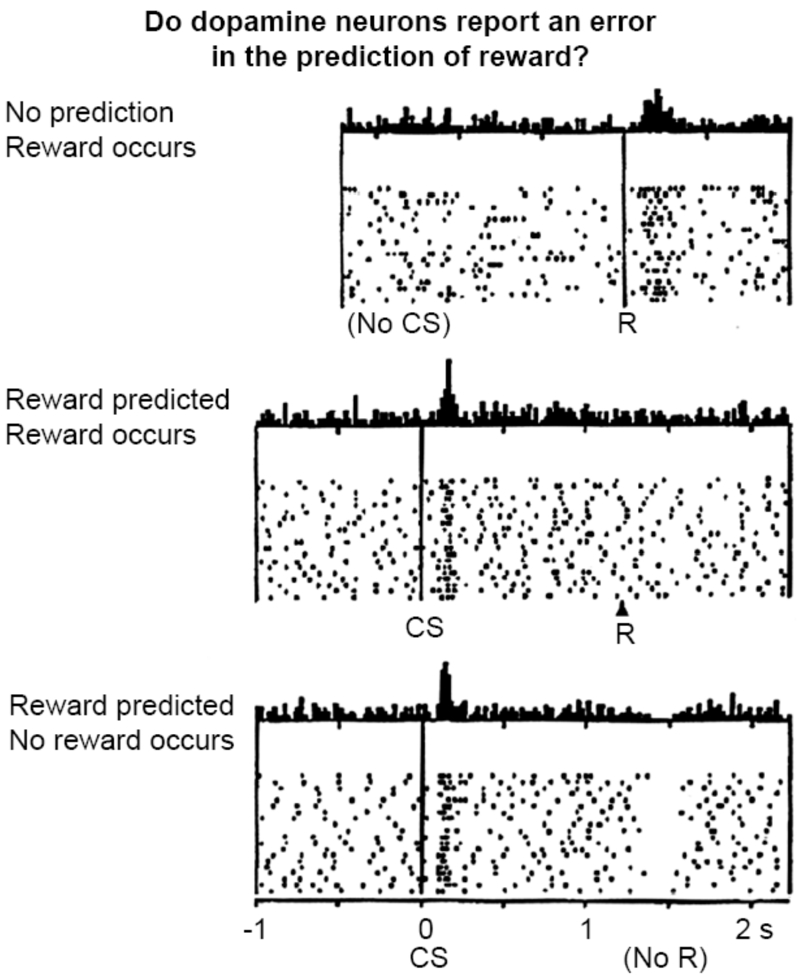
Vorhersage der Belohnung ?!

A Neural Substrate of Prediction and Reward

Wolfram Schultz, Peter Dayan, P. Read Montague*

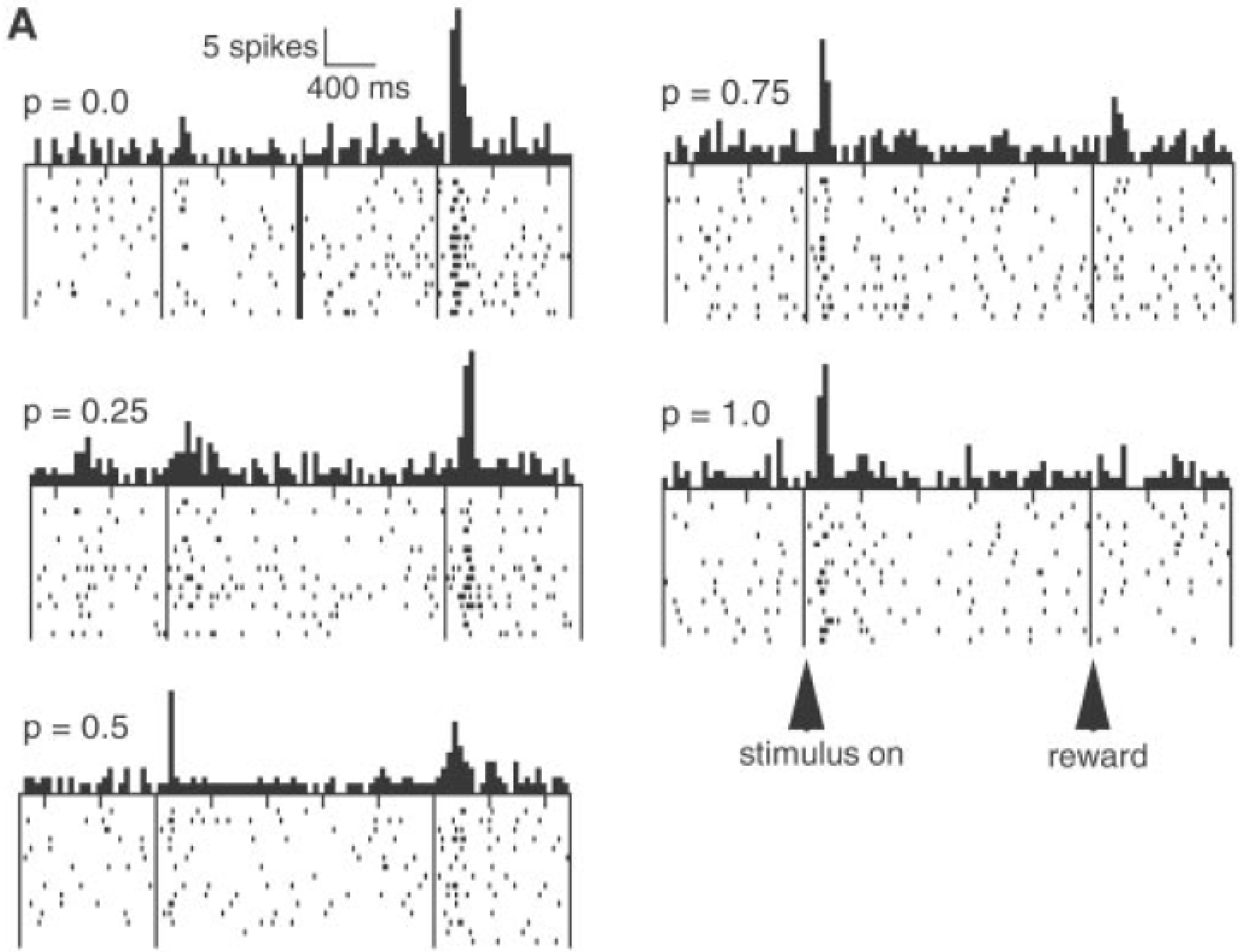
The capacity to predict future events permits a creature to detect, model, and manipulate the causal structure of its interactions with its environment. Behavioral experiments suggest that learning is driven by changes in the expectations about future salient events such as rewards and punishments. Physiological work has recently complemented these studies by identifying dopaminergic neurons in the primate whose fluctuating output apparently signals changes or errors in the predictions of future salient and rewarding events. Taken together, these findings can be understood through quantitative theories of adaptive optimizing control.

Neuronale Grundlagen

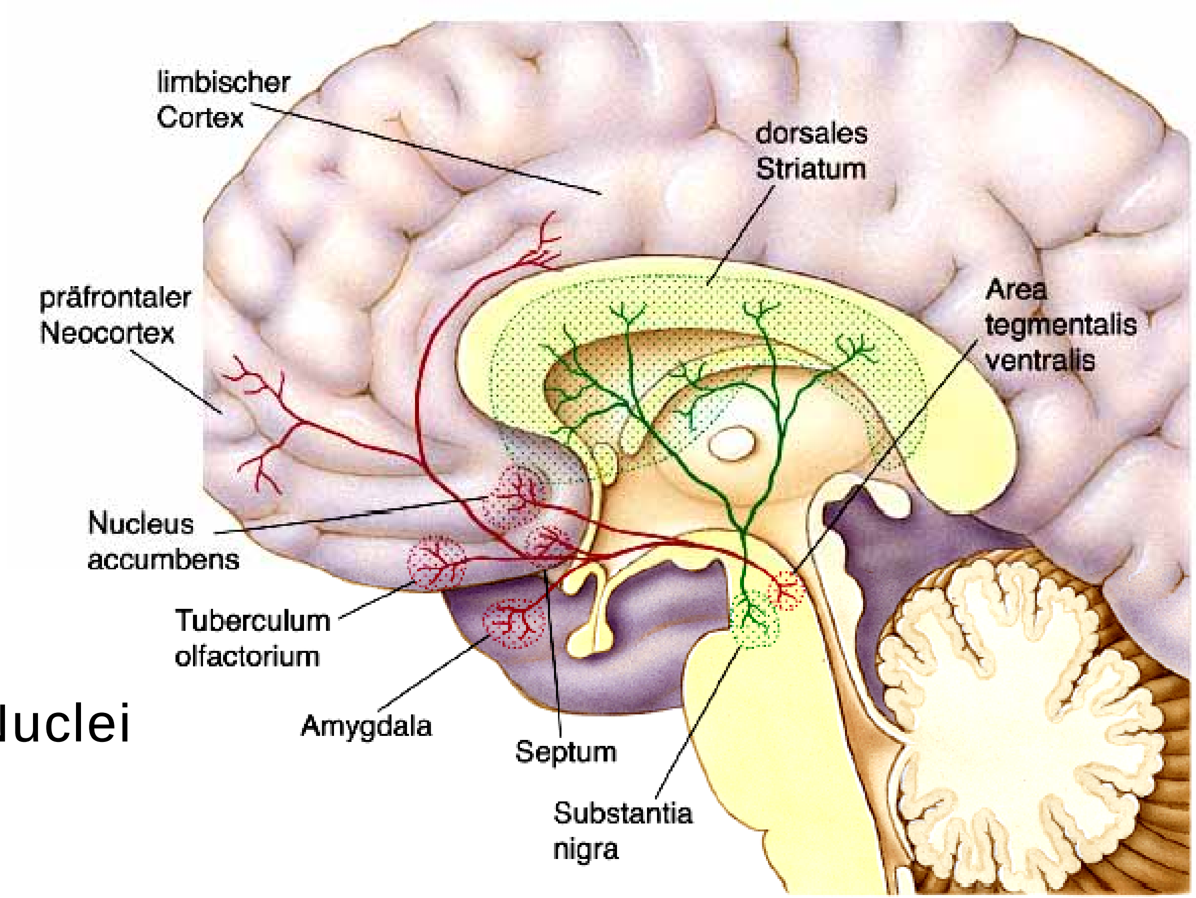


	unerwartete Belohnung
-	+ Dopamin
Vorhersage +	+ Belohnung - Dopamin
Vorhersage +	- Belohnung - Dopamin

Vorhersage der Belohnung ?!

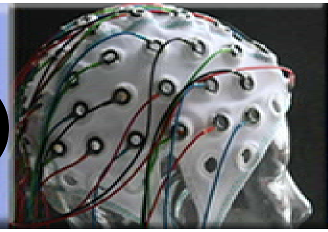


Mesotelencephales Dopaminsystem (MDS)



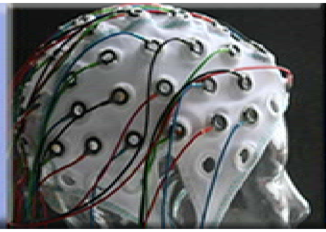
Ansammlung von Nuclei
Substantia Nigra,
Ncl accumbens,
Ventrales Tegmentum

Mesotelencephales Dopaminsystem (MDS)



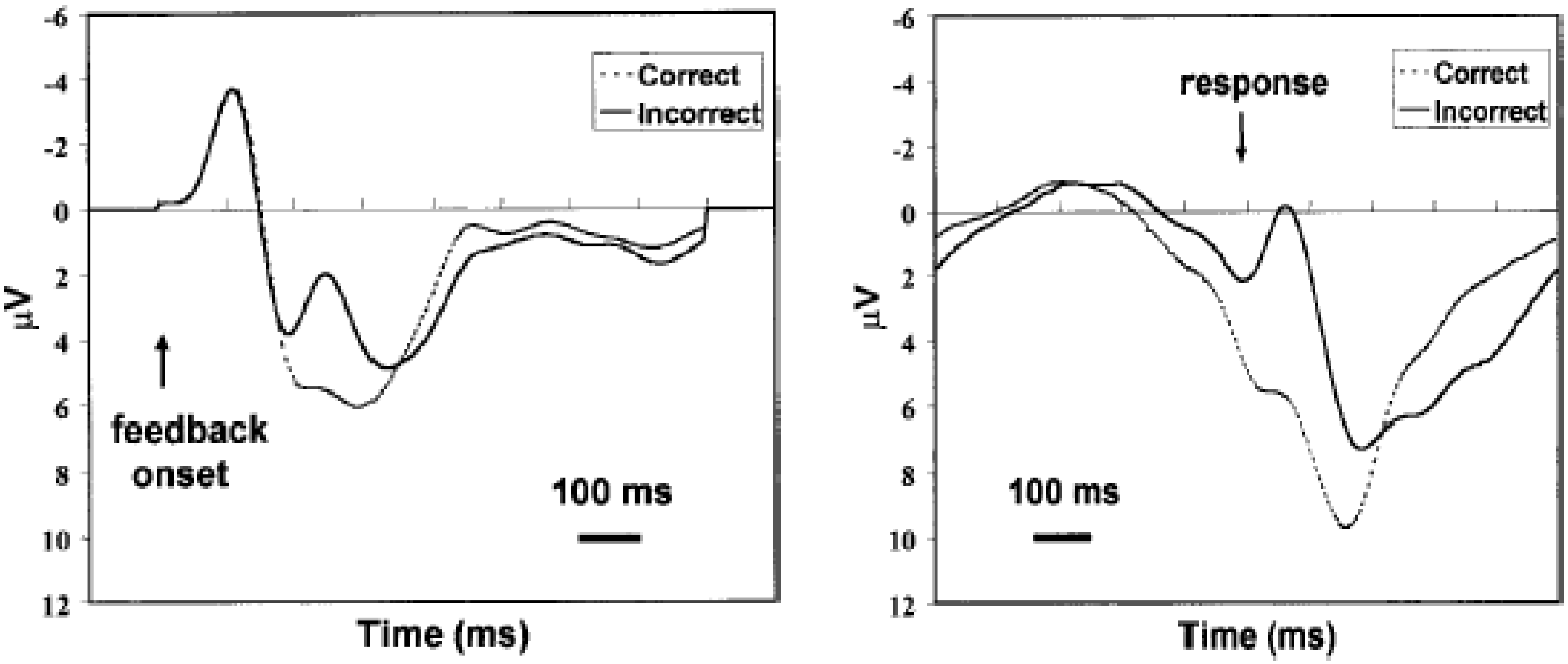
- Sendet Verstärker in Form von Dopaminausschüttung zu den Basalganglien u. dem frontalen Cortex (AGC)
- Ermöglicht Basalganglien konditionierte Verknüpfungen anzuwenden, die zur Erstellung neuer motorischer Programme nötig sind

Elektrophysiologische Korrelate beim Menschen ?



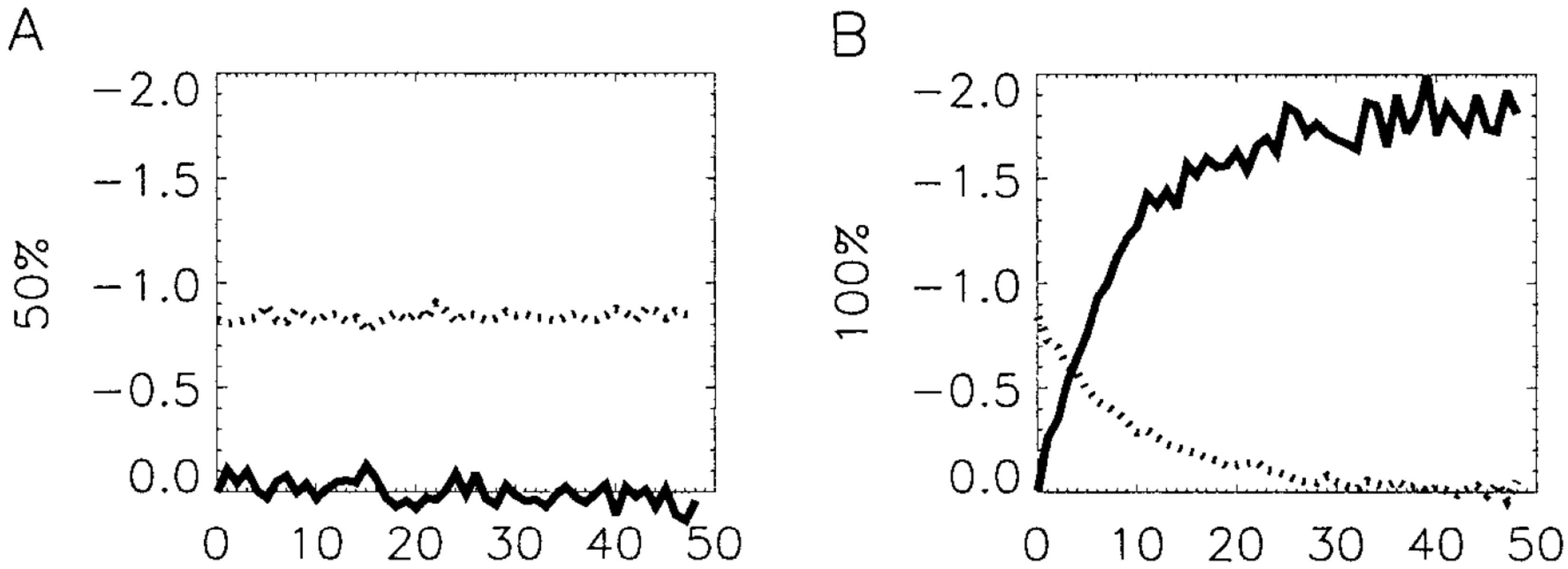
- Experimentalaufbau:
  - Reaktion auf Stimuli: 2 Möglichkeiten, richtig-falsch
  - Mehrere Blöcke a 6 Stimuli
  - Drei verschiedene Zuordnungs-Bedingungen:
    - 100% und 50%
    - Random

Error Related Negativity (ERN) auf Fehler und auf Feedback

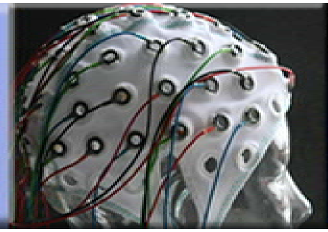


50 % Bedingung

100 % Bedingung



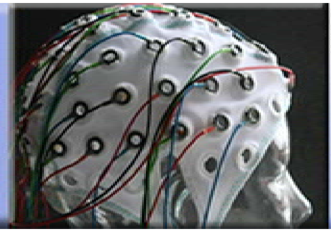
ERN über den Lernverlauf



- 100% Bedingung:
  - Feedback bezogene ERN nimmt ab
  - Response bezogene ERN größer als Feedback-ERN
  - Vergrößerung der Differenz während Lernverlauf

  → System verlässt sich auf eigene Repräsentation der korrekten Antwort

ERN und Lernstrategien



- Zwei Lernstrategien:
  - Positiv Lerner: lernen aus pos. Feedback
  - Negativ Lerner: lernen aus neg. Feedback
- ERN als Indikator dafür, ob VPn eher aus pos. oder neg. Feedback lernt

ERN und Lernstrategien

By Carrot or by Stick: Cognitive Reinforcement Learning in Parkinsonism

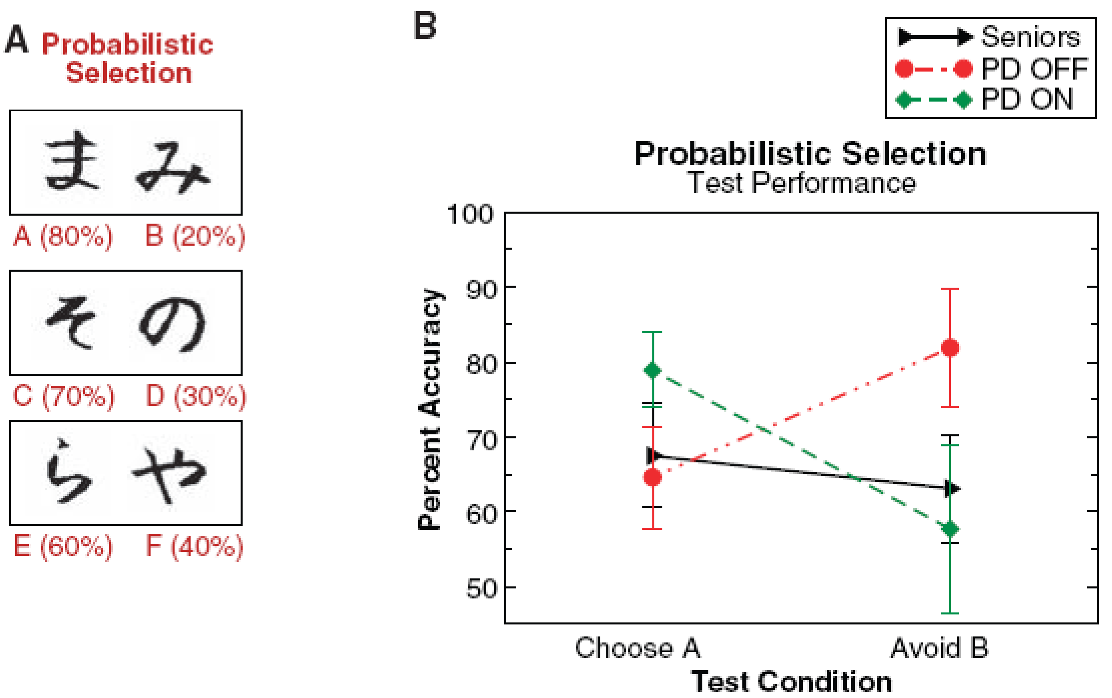
Michael J. Frank,[1]* Lauren C. Seeberger,[2] Randall C. O'Reilly[1]*

To what extent do we learn from the positive versus negative outcomes of our decisions? The neuromodulator dopamine plays a key role in these reinforcement learning processes. Patients with Parkinson's disease, who have depleted dopamine in the basal ganglia, are impaired in tasks that require learning from trial and error. Here, we show, using two cognitive procedural learning tasks, that Parkinson's patients off medication are better at learning to avoid choices that lead to negative outcomes than they are at learning from positive outcomes. Dopamine medication reverses this bias, making patients more sensitive to positive than negative outcomes. This pattern was predicted by our biologically based computational model of basal ganglia–dopamine interactions in cognition, which has separate pathways for "Go" and "NoGo" responses that are differentially modulated by positive and negative reinforcement.

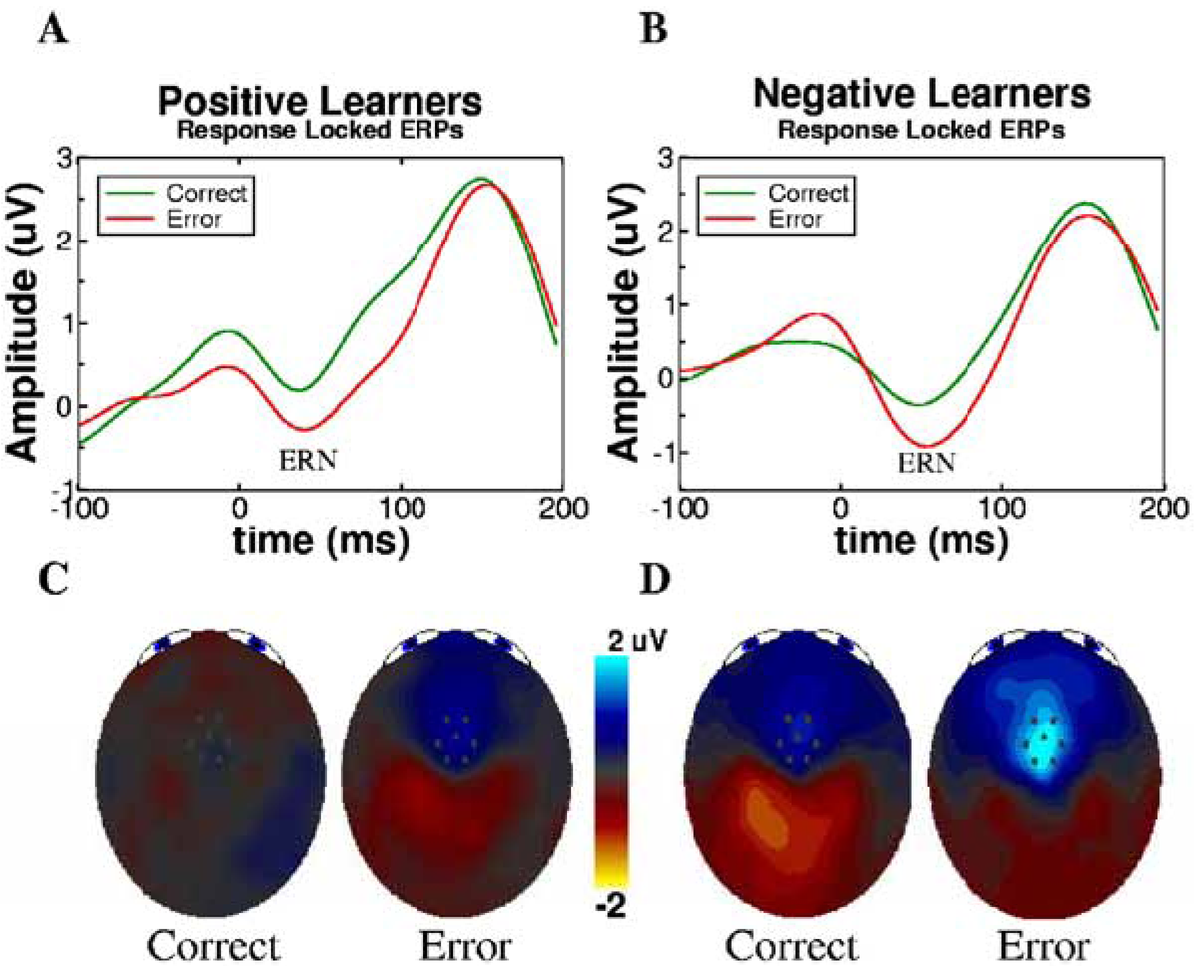
account is that cognitive performance should improve when patients take medication that elevates their dopamine levels. However, a somewhat puzzling result is that dopamine medication actually worsens performance in some cognitive tasks, despite improving it in others (*6*, *7*).

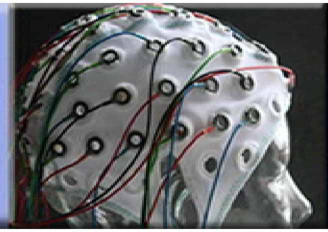
Computational models of the basal ganglia–dopamine system provide a unified account that reconciles the above pattern of results and makes explicit predictions about the effects of medication on carrot-and-stick learning (*8*, *9*). These models simulate transient changes in dopamine that occur during positive and negative reinforcement and their differential effects on two separate pathways within the basal ganglia system. Specifically, dopamine is excitatory on the direct or "Go" pathway, which helps facilitate responding, whereas it is inhibitory on the indirect or "NoGo" pathway, which suppresses responding (*10*–*13*). In animals, phasic bursts of dopamine cell firing are observed during positive reinforcement

Positiver oder negativer Lerner liegt am Dopamin

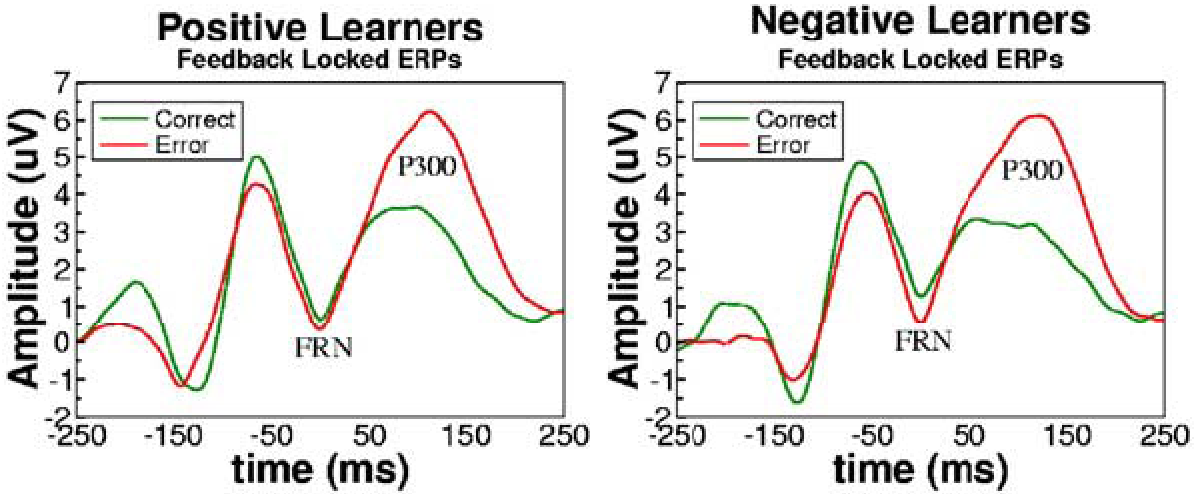


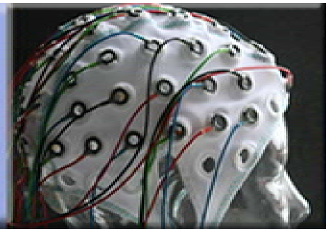
Größere ERN für negative Lerner





Positive Lerner profitieren von positivem Feedback



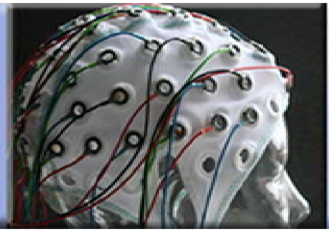


Dopamin und Lernstrategie

- Lernstrategie abhängig vom Dopaminlevel in den Basalganglien
- Negatives Feedback führt zu dips im Dopaminspiegel und begünstigt dadurch NoGo – Learning: die gleiche Antwort wird in Zukunft vermieden
- ERN wird durch dieselben Dopamin dips induziert

  → ERN ist größer für Negative Lerner, die eher aus negativem Feedback lernen

Belohnung oder Bestrafung ?



Psychophysiology, 41 (2004), 245–253. Blackwell Publishing Inc. Printed in the USA.

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Context dependence of the event-related brain potential associated with reward and punishment

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[b] Department of Psychology, Texas Tech University, Lubbock, Texas 79409, USA
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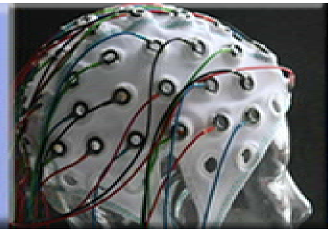
Abstract

The error-related negativity (ERN) is an event-related brain potential elicited by error commission and by presentation of feedback stimuli indicating incorrect performance. In this study, the authors report two experiments in which participants tried to learn to select between response options by trial and error, using feedback stimuli indicating monetary gains and losses. The results demonstrate that the amplitude of the ERN is determined by the value of the eliciting outcome relative to the range of outcomes possible, rather than by the objective value of the outcome. This result is discussed in terms of a recent theory that holds that the ERN reflects a reward prediction error signal associated with a neural system for reinforcement learning.



Belohnung oder Bestrafung ?

neutral

-10 0 +10

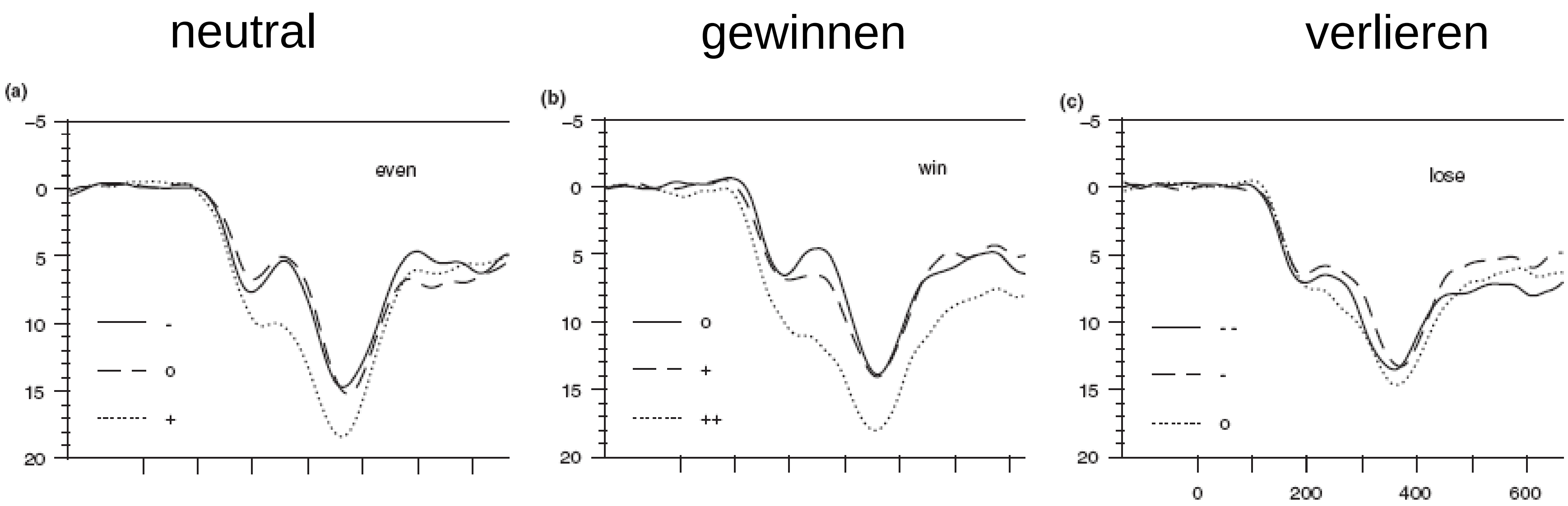
gewinnen

0 +5 +10

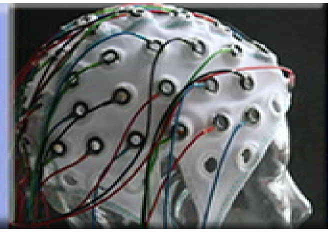
verlieren

-10 -5 0

Belohnung oder Bestrafung ?

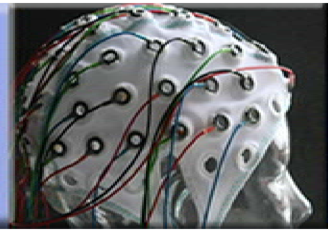


Belohnung oder Bestrafung ?



- Belohnung ist relativ
- Aber: Positv- / Negativlerner?
  Größe der Belohnung/Bestrafung?
  Geschlechterunterschiede?
  ...

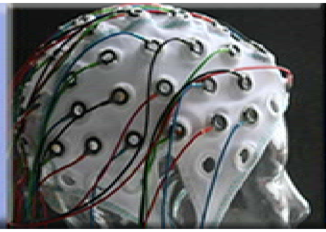
Thema 2: Sprache und Emotionen



Kann man Emotionen verbal ausdrücken ?

- Emotionsbeschreibung: z.B. Eifersucht
- Emotionale Inhalte: meine Lieblingsverein ist CL-Sieger
- Emotionale Prosodie: z.B. Fluchen

Emotionsbeschreibung



Research Article

Putting Feelings Into Words

Affect Labeling Disrupts Amygdala Activity in Response to Affective Stimuli

Matthew D. Lieberman, Naomi I. Eisenberger, Molly J. Crockett, Sabrina M. Tom, Jennifer H. Pfeifer, and Baldwin M. Way

University of California, Los Angeles

ABSTRACT—*Putting feelings into words (affect labeling) has long been thought to help manage negative emotional experiences; however, the mechanisms by which affect labeling produces this benefit remain largely unknown. Recent neuroimaging studies suggest a possible neurocognitive pathway for this process, but methodological limitations of previous studies have prevented strong inferences from being drawn. A functional magnetic resonance imaging study of affect labeling was conducted to remedy these limitations. The results indicated that affect labeling, relative to other forms of encoding, diminished the response of the amygdala and other limbic regions to negative emotional images. Additionally, affect labeling produced increased activity in a single brain region, right ventrolateral prefrontal cortex (RVLPFC). Finally, RVLPFC and amygdala activity during affect labeling were inversely correlated, a relationship that was mediated by activity in medial prefrontal cortex (MPFC). These results suggest that affect labeling may diminish emotional reactivity along a pathway from RVLPFC to MPFC to the amygdala.*

Putting feelings into words has long been thought to be one of the best ways to manage negative emotional experiences. Talk therapies have been formally practiced for more than a century and, although varying in structure and content, are commonly based on the assumption that talking about one's feelings and problems is an effective method for minimizing the impact of negative emotional events on current experience. More recently, psychologists have discovered that merely putting pen to paper to express one's emotional ailments has benefits for mental and physical health (Hemenover, 2003; Pennebaker, 1997). Although conventional wisdom and scientific evidence indicate that putting one's feelings into words can attenuate negative emotional experiences (Wilson & Schooler, 1991), the mechanisms by which these benefits arise remain largely unknown.

Recent neuroimaging research has begun to offer insight into a possible neurocognitive mechanism by which putting feelings into words may alleviate negative emotional responses. A number of studies of *affect labeling* have demonstrated that linguistic processing of the emotional aspects of an emotional image produces less amygdala activity than perceptual processing of the emotional aspects of the same image (Hariri, Bookheimer, & Mazziotta, 2000; Lieberman, Hariri, Jarcho, Eisenberger, & Bookheimer, 2005). Additionally, these studies have demonstrated greater activity during linguistic processing than during nonlinguistic processing of emotion in right ventrolateral prefrontal cortex (RVLPFC), a region associated with the symbolic processing of emotional information (Cunningham, Johnson, Gatenby, Gore, & Banaji, 2003; Nomura et al., 2003) and with top-down inhibitory processes (Aron, Robbins, & Poldrack, 2004). Finally, the magnitude of RVLPFC activity during affect labeling has been inversely correlated with the magnitude of amygdala activity during affect labeling in these studies. Together, these results suggest that putting feelings into words may activate RVLPFC, which in turn may dampen the response of the amygdala, thus helping to alleviate emotional distress.

In studies of affect labeling, an emotionally evocative image is usually shown along with two options for categorizing the image. The images in Figures 1a and 1b provide examples of typical *affect-label* and *affect-match* trials, respectively. During affect-label trials (i.e., linguistic processing of affect), a pair of affective labels is presented at the bottom of the screen, and the subject chooses the label that best characterizes the emotion displayed by the target face at the top of the screen. During affect-match trials (i.e., nonlinguistic processing of affect), a

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Emotionsbeschreibung

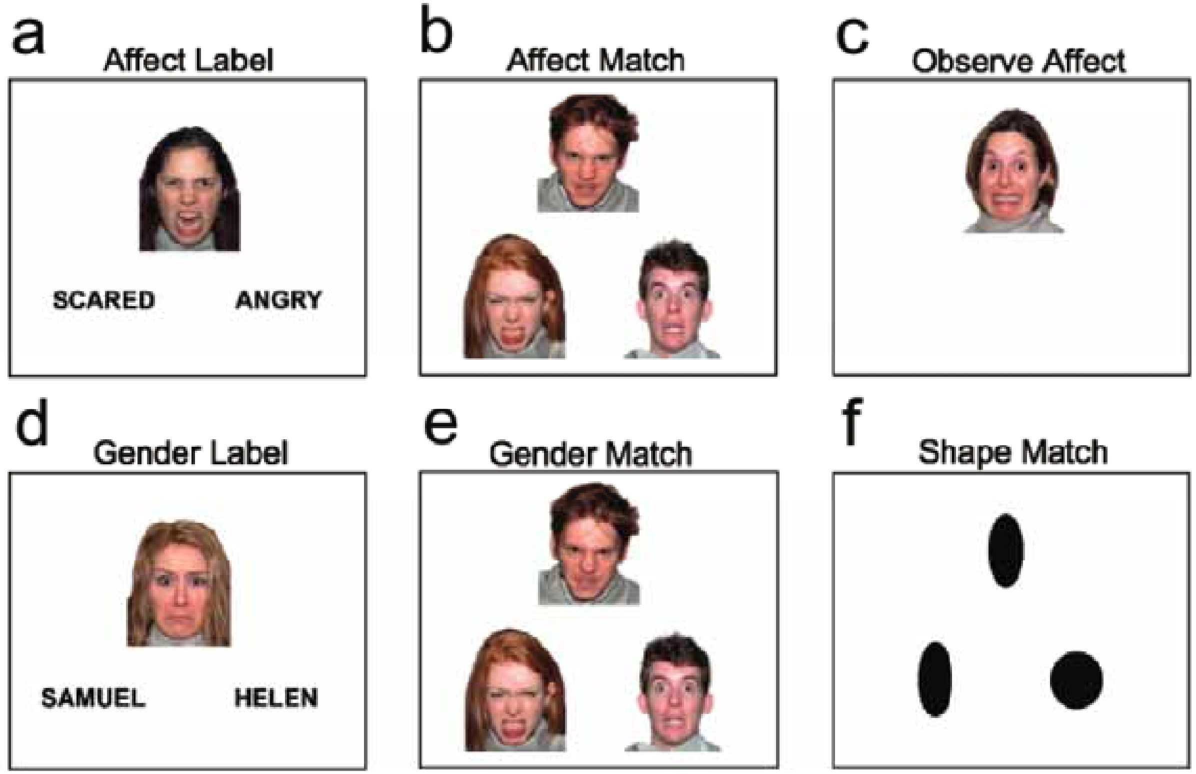
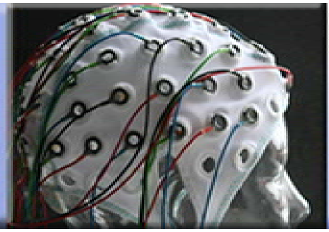


Fig. 1. A sample display from each of the six types of experimental trials.



Emotionsbeschreibung

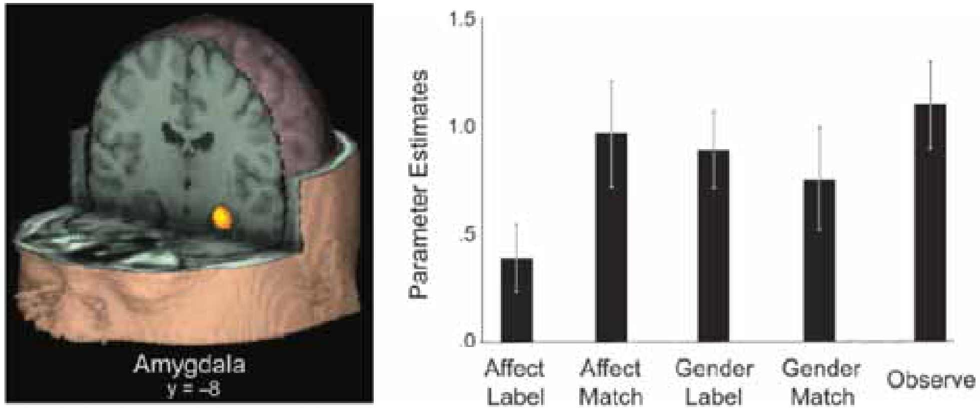


Fig. 2. Parameter estimates of activity during five conditions (relative to activity in the shape-match control condition) in an amygdala region of interest (ROI). The ROI was identified by comparing activity in the observe condition and activity in the shape-match condition. The illustration on the left shows an axial slice indicating the extent of the ROI.

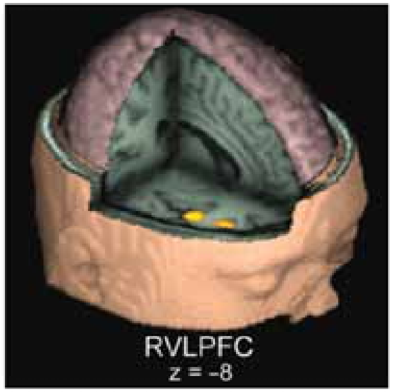
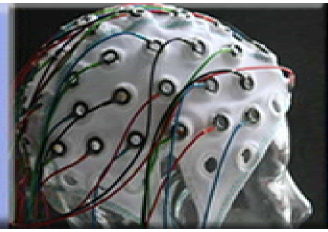


Fig. 3. Illustration of a canonical brain showing two clusters in right ventrolateral prefrontal cortex (RVLPFC) where activity was greater during affect labeling than during gender labeling.



Emotionsbeschreibung

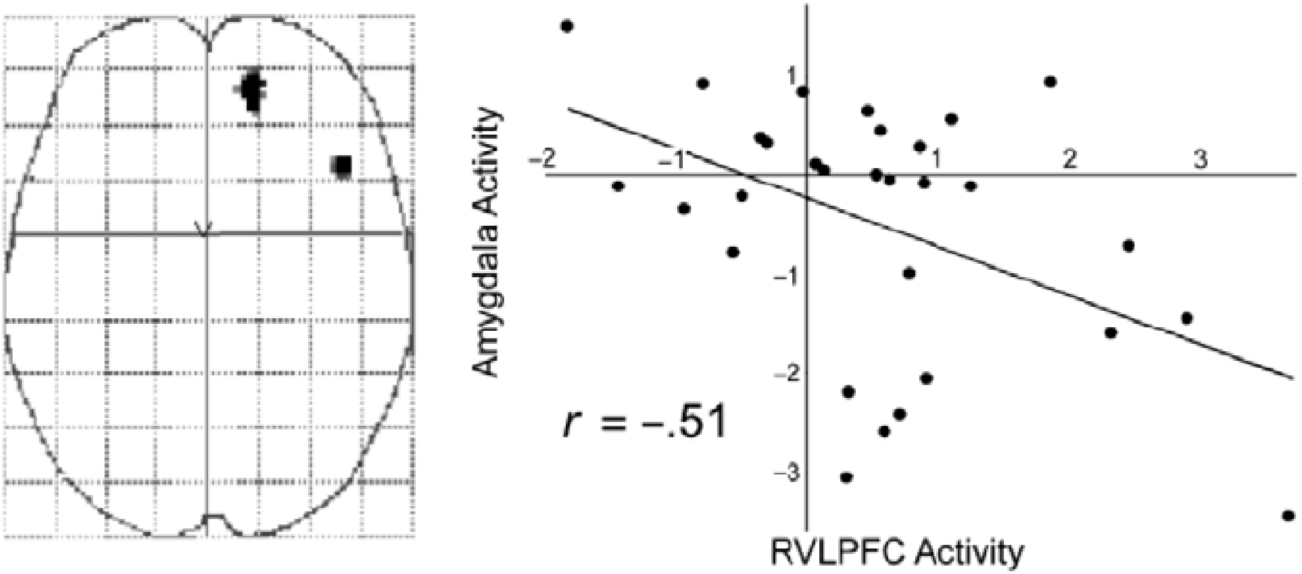
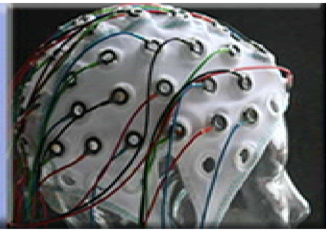


Fig. 4. Correlation between right ventrolateral prefrontal cortex (RVLPFC) and amygdala activity. Each plotted point represents the parameter estimates for a single subject's activity in RVLPFC and the amygdala during affect labeling, relative to gender labeling. The view of the glass brain on the left shows all brain regions (RVLPFC and medial prefrontal cortex) for which activity was inversely correlated with amygdala activity during affect labeling, relative to gender labeling.



PSYCHOLOGICAL SCIENCE

Research Report

Buzzwords

Early Cortical Responses to Emotional Words During Reading

Johanna Kissler,[1] Cornelia Herbert,[1] Peter Peyk,[2] and Markus Junghofer[3]

[1]University of Konstanz, Konstanz, Germany; [2]University of Basel, Basel, Switzerland; and [3]Institute for Biomagnetism and Biosignal Analysis, University of Münster, Münster, Germany

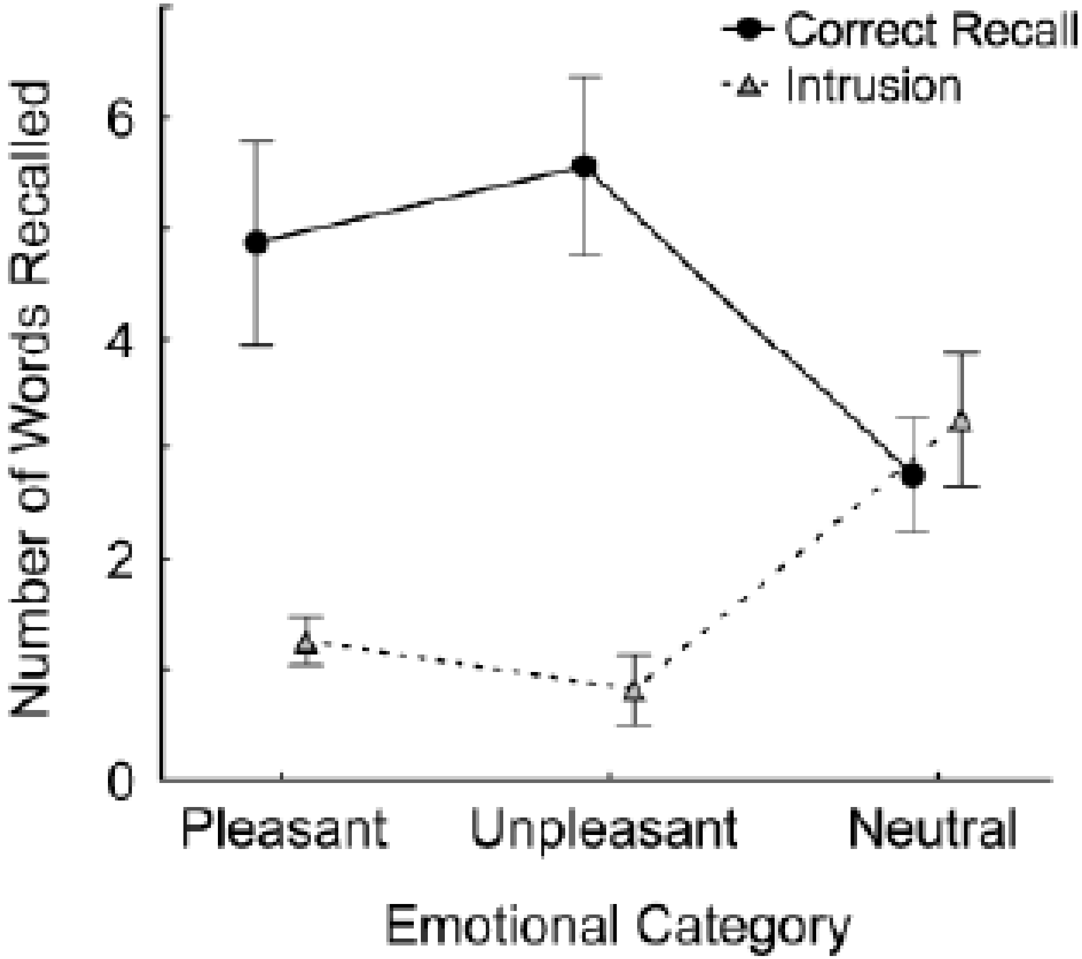
ABSTRACT—*Electroencephalographic event-related brain potentials were recorded as subjects read, without further instruction, consecutively presented sequences of words. We varied the speed at which the sequences were presented (3 Hz and 1 Hz) and the words' emotional significance. Early event-related cortical responses during reading differentiated pleasant and unpleasant words from neutral words. Emotional words were associated with enhanced brain responses arising in predominantly left occipito-temporal areas 200 to 300 ms after presentation. Emotional words were also spontaneously better remembered than neutral words. The early cortical amplification was stable across 10 repetitions, providing evidence for robust enhancement of early visual processing of stimuli with learned emotional significance and underscoring the salience of emotional connotations during reading. During early processing stages, emotion-related enhancement of cortical activity along the dominant processing pathway is due to arousal, rather than valence of the stimuli. This enhancement may be driven by cortico-amygdaloid connections.*

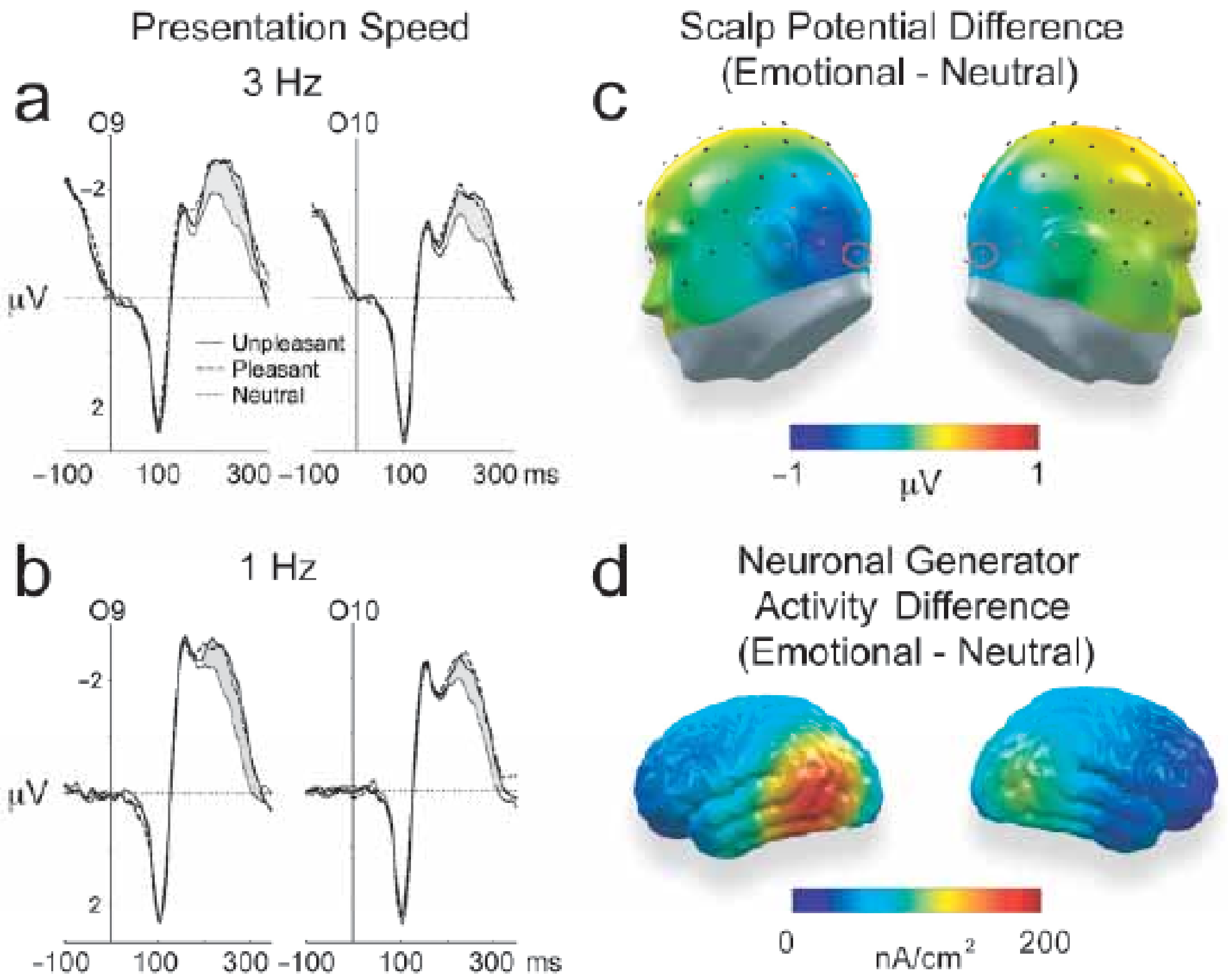
pleasant or unpleasant are usually also rated as being highly arousing (Bradley & Lang, 1994).

Although the idea that emotional concepts have a dimensional structure was first suggested on the basis of linguistic analysis (Osgood, Suci, & Tannenbaum, 1975), emotion research has since focused mainly on the processing of nonlinguistic stimuli, advancing understanding of how emotional facial expressions (Schupp, Öhman, et al., 2004; Vuilleumier, Richardson, Armony, Driver, & Dolan, 2004) and pictures (Junghöfer, Bradley, Elbert, & Lang, 2001; Schupp, Junghöfer, Weike, & Hamm, 2003; Schupp, Öhman, et al., 2004; Schupp et al., 2006) are processed. Responses to such stimuli are at least partly based on biological predisposition (Öhman & Mineka, 2001). Words, by contrast, are entirely symbolic; their meaning is acquired by learning.

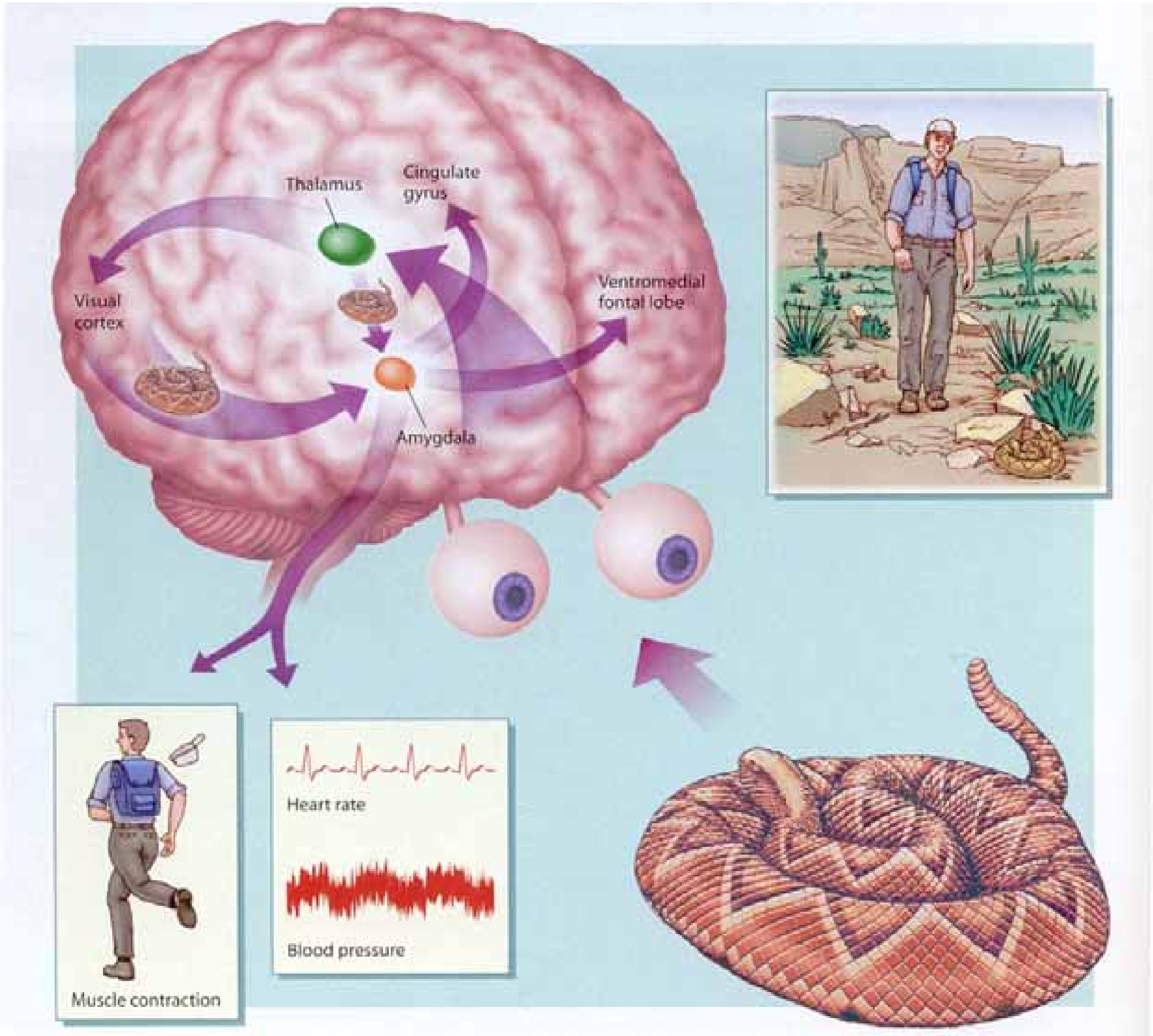
Some initial event-related potential (ERP) studies used words with different emotional connotations as stimuli (Begleiter & Platz, 1969; Lifshitz, 1966), albeit with mixed results. Visually inspecting the data, Lifshitz did not find marked ERP differences between words varying in emotional content; however, Begleiter and Platz, examining results from a single electrode, reported that words with different emotional content elicited

Recall Performance

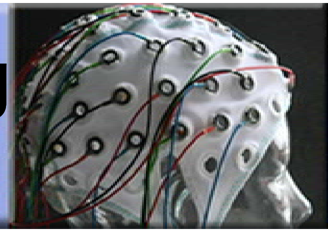



Presentation Speed
a
3 Hz
O9
O10
-2
μV
2
Unpleasant
Pleasant
Neutral
-100
100
300
-100
100
300 ms
b
1 Hz
O9
O10
-2
μV
2
-100
100
300
-100
100
300 ms
c
Scalp Potential Difference
(Emotional - Neutral)
-1
μV
1
d
Neuronal Generator
Activity Difference
(Emotional - Neutral)
0
nA/cm²
200

Low road / high road

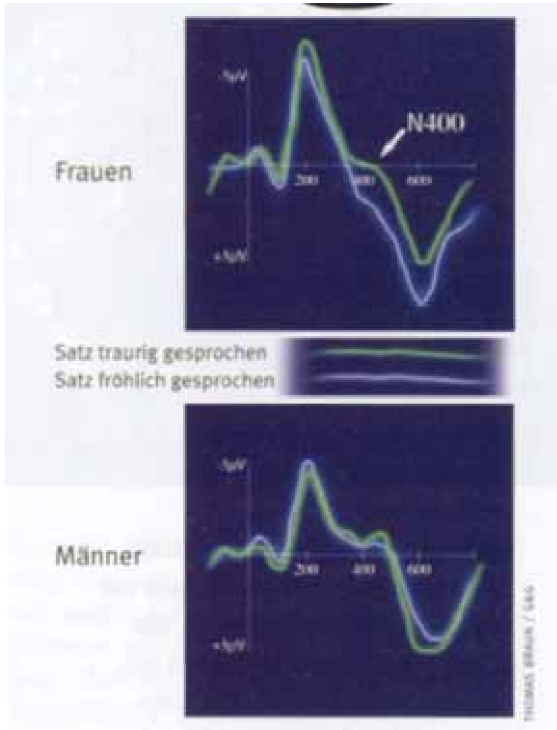


Gender Differences in the Processing of Emotional Prosody



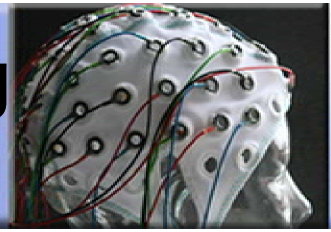
"Men don't really understand !

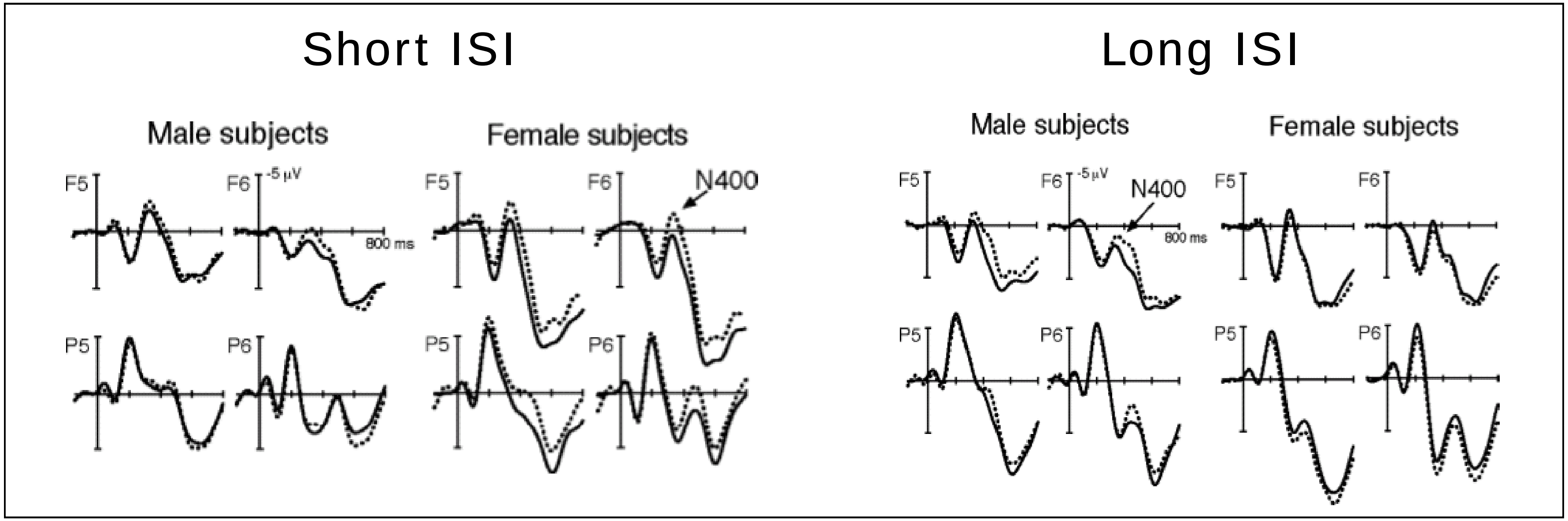
There are pronounced gender differences in the time course of processing emotional prosody"



Schirmer et al. (2002, 2003)

Gender Differences in the Processing of Emotional Prosody





Schirmer et al. (2002, 2003)

Aber:

- Valenz vs Arousal ?
- Geschlechtsunterschiede ?
- Positiv vs Negativlerner?