

The Biological Correlates of Emotions¹

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Abstract

In recent years there has been an increased interest in research into emotions in terms of neurobiological correlates as well as psychotherapeutic impact. In this article we discuss some methods that have been used to find biological correlates of emotions. Furthermore, we give an overview of contemporary theories concerning basic emotions.

Based on the well known neurobiological pathways of fear, we propose hypotheses concerning which neurobiological structures and functions are involved, respectively, in attitudinal work, and which are involved during the bonding experience. – These hypotheses may further elucidate why implicit memory content becomes conscious during these forms of therapy, and why a corrective emotional experience is thus made possible.

Keywords: Basic emotions, Biology, Bonding Psychotherapy, Attitude, Neuroscience.

Das biologischen Wechselbeziehungen von Gefühlen

Zusammenfassung

In den vergangenen Jahren gab es ein wachsendes Interesse an den Forschungen der neurobiologischen Wechselbeziehungen sowie deren psychotherapeutische Auswirkung. In diesem Artikel diskutieren wir einige Methoden welche gebraucht wurden um die biologischen Wechselwirkungen der Gefühle zu finden. Im Weiteren geben wir einen Überblick von zeitgenössischen Theorien, welche die grundlegenden Gefühle betreffen. Basierend auf dem gut bekannten neurobiologischen Pfad der Angst, schlagen wir eine Hypothese vor, über welche neurobiologischen Strukturen und Funktionen, die Einstellung betreffend und welche in der Bindungserfahrung beteiligt sind. Diese Hypothesen könnten die weitere Einsicht ermöglichen, warum in dieser Therapieform die unausgesprochenen Gedächtnisinhalte bewusst werden und warum dadurch eine korrektive Erfahrung möglich wird.

Schlüsselwörter: Grundgefühle, Biologie, Bindungspsychotherapie, Ansichten

Les correspondances biologiques des émotions

Résumé

Ces dernières années, on s'est plus intéressé à la recherche sur les émotions en termes de corrélations neurobiologiques ainsi que de l'effet psychothérapeutique de ces dernières. Dans le présent article, nous présentons quelques-unes des méthodes qui ont été utilisées pour cerner les correspondances biologiques des émotions. Nous offrons en outre un aperçu des

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théories qui existent maintenant sur les émotions de base.

Nous référant aux circuits neurobiologiques bien connus associés à la peur, nous proposons certaines hypothèses concernant les structures et fonctions biologiques impliquées, les attitudes concernées et la question de savoir quels sont les éléments trouvés dans l'expérience de l'attachement. Ces hypothèses pourraient contribuer à répondre à la question de savoir pourquoi les contenus implicites de la mémoire deviennent conscients durant certaines formes de thérapie et pourquoi il est alors possible d'offrir au client une expérience émotionnelle qui lui permettra d'apporter des corrections.

Mots-clés : Émotions de base, biologie, psychothérapie par l'attachement, attitude

Биологические корреляты эмоций

Резюме:

В последние годы возрос интерес к исследованиям нейробиологических коррелятов эмоций и воздействия эмоций на психотерапевтический процесс. В данной статье мы обсуждаем некоторые методы, использованные для нахождения биологических коррелятов эмоций. Кроме того, мы предлагаем общий обзор современных теорий базовых эмоций.

Основываясь на хорошо известных нейробиологических путях формирования страха, мы выдвигаем гипотезы, что нейробиологические структуры и функции соответствующим образом вовлечены в работу с установками и в опыт переживания бондинга. Более того, данные гипотезы могут объяснить, почему в результате применения таких форм терапии становится осознанным имплицитное содержимое памяти и, соответственно, почему возможен корректирующий эмоциональный опыт.

Ключевые слова: базовые эмоции, биология, бондинг-терапия, установка

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Introduction

Whilst, for a long time, emotions in psychological research were a rarely sought after topic, interest in emotional research has grown during the last 15 years: LeDoux (1998, 2002), Panksepp (1998), Damasio (1997) and Sulz (2005) give an overview of the state of research. In addition, modern research methods make it possible to locate brain-morphological and physiological correlates of psychological processes – and also of emotions. Functional methods, for example functional magnetic resonance imaging (*fMRI*), reach beyond classical neuropsychology that only correlated psychic functions with structural brain defects.

This article gives an overview of various methods of psycho-biological research, and of the biological correlates of some emotions, especially fear. It will refer to the state of knowledge concerning basic emotions, and we draft some hypotheses about which brain areas are involved during Bonding Psychotherapy and attitude work in the context of Casriel-Therapy (Casriel 1972).

The definition of “emotion” as an umbrella term is difficult. One has to consider if “emotion” or “feeling” is a general term for certain sensations which we have learned to name as “emotions” or “feelings”, but which do not necessarily have a common reality. LeDoux mentions in this context: “*Emotion*’ is just a label, a common way to talk about aspects of the brain and its rationality.” (LeDoux 1998)

Basic emotions

It seems to be old empirical knowledge that humans distinguish "primary" or "basic" emotions from "secondary" or "complex" emotions. This seems to go back to the experience that humans can often feel different emotions simultaneously, or in rapid alternation, and that very strong emotions are often felt as "pure". In addition, the basic vocabulary in most languages (those 100-200 words that make 50 % of common everyday language) contains terms for certain emotions. This can bring up the question whether the original emotions (not determined by language) are expressed by certain verbal terms, or if language itself influences feelings with predefined words (refer to: Whorf, 1956) on the normative potency of language).

In philosophy, reflection on emotions played an important role from the beginning. The particular significance of fear was worked out by Kierkegaard (2003) and in existential philosophy (Sartre, 1993; Jaspers, 1938 & 1947).

In psychiatric literature, emotions – often divided into basic emotion, current affect and affective fluctuation – belong to the categories of psychological or psychopathological findings (AMDP, 2000; Jaspers, 1946).

However, everyday language seems to subsume some heterogeneous issues under the same umbrella term "emotion" (see Chart 1).

grief	
fear / anxiety	
pleasure, joy, wellbeing	
hunger	
thirst	
sexual lust	
being in love	
vibration	} <i>body "feelings" or sensations</i>
heat (skin)	
salty (tongue)	
tension (muscles)	

Chart 1: List of different conditions referred to as "emotions"

So how can we categorize emotions? What are basic emotions? How, and with which result, can we establish a set of basic emotions or identify basic emotions? The term 'basic' suggests that there are fundamental emotions that cannot be reduced to other emotions. This makes sense only if it implies that there are other – not basic – emotions that derive from basic emotions, or are assembled from basic emotions.

A general biological system of emotions?

While to "common sense" (possibly equatable with uncritical introspection), certain body senses (for example, spatial orientation) and affects (for example, fear) appear as different categories; other "emotions", such as disgust, shame, joy/pleasure or triumph, are considered to belong to a special category. It seems plausible to assume a consistent biological system as carrier for these "emotions". The limbic system was considered to be this carrier of emotions, but that seems to be a somewhat inexact understanding. Indeed, it is true that many structures

of the limbic system are involved in a number of emotional processes. On the other hand, other brain structures are also involved in generation, perception and actualization of emotions; for example, the anterior gyrus cinguli and the insular cortex are responsible for affective pain processing, the dorsal gyrus cinguli for regulation of perception of emotions (overview over neuro-anatomy of emotions processes: see Bauer, 2005; Phillips, 2003).

Groups of psychological functions (perception, thinking, motivation, emotion and will) are perhaps not clearly distinguished brain functions – even if they are fundamental categories of occidental philosophical reflection (according to Hegel and Kant). Just as there is no neurobiological structure that is in charge for all categories of perception, but distinct systems for hearing, vision, smelling etc., apparently there is no particular neurobiological system that is generally responsible for emotions (LeDoux, 1998). All the more, the focus in research on psycho-biological correlations is on certain classes of emotions, i.e. certain basic emotions.

Classification of emotions

The abundance of words for emotions seems to reflect a similar broad variety of emotional nuances. The German language knows dozens of words for emotional and related conditions (see Dornseiff, 2004). Plutchik (2002, p. 78) lists 142 English terms for emotional conditions. In one of our clinical studies, when patients named their main emotions during a trance-induced Doppelgänger experience, we found 307 terms for emotional conditions (Stadtmüller et al., 2004).

There were many approaches to classify this abundance (overview in Birbaumer & Schmidt, 2010). Distinctions were made based on introspection, linguistic analysis, terminological considerations, body expression, phonetic expression and biological correlates.

1. **Linguistic approach:** With methods of linguistic research, it is possible to analyze patterns of words used in similar emotional contexts. Another approach is the question, if (and which) different words are used for different emotions.
2. **Term logic:** Term logical considerations go further into the question: Are certain emotions a combination of two or more emotions, an emotion and an action, an emotion and a tendency (intention)? For example: Hate can be understood as anger connected with the tendency to injure or to kill. If one looks at it this way, the hate-inherent tendency to injure would be morally questionable, while the “pure” anger-affect, as such, would not. Following this consideration one could ask if the condemnation of anger predominant in many moral systems can be changed by further analyses. Although currently grief is most often considered a basic emotion, it could, in an analog way, possibly be understood as a combination of an emotion and appetite (a longing for). Following this, the emotional aspect of grief would be the pain about a separation (not having something/somebody any more or not yet). The appetite in grief would be the yearning to have or to be close to the loved “object”.
3. **Expressional movement:** Are different emotions characterized by different physical movements, particularly gesticulation and mimic expression? Are facial expressions for certain affects trans-culturally invariant? Which facial expressions are identical for similar emotions in ethnic groups that are not influenced by each other? Which facial expressions for certain emotions are influenced by culture? Human ethology has provided information regarding these questions, and has shown that many facial expressional movements are naturally inborn, and are not (or are minimally) influenced by culture (Wickler, 1972; Eibl-Eibesfeld, 2007; notably also Ekman, 2004).

4. **Phonetic expression:** In an analogous way, one can research the question as to what extent phonetic expression of certain emotions is trans-culturally invariant, or culturally influenced.
5. **Psychobiological correlations:** The same biological correlates for differently named emotions can be an indication that the same underlying emotion is involved. Divergent biological correlates can indicate different biological processes for one underlying emotion, but do not necessarily indicate *basic* emotions.

In this article, we outline suitable *methods* to describe some of the psychobiological correlations without going into detailed results. An extensive review would fill a handbook: overviews by LeDoux (1998, 2002), Damasio (1996), Rost (2001), see also Bauer (2005). With regards to the question of basic emotions, we will list relevant results below:

- 5.1. **Classical neuropsychology:** Neuropsychology is based on the correlation of structural brain lesions with psychological functions. Substantial findings were gained by studying brain lesions (Kleist, 1934). The famous case of Phineas P. Gage in 1848 helped to understand that the frontal lobe is an important structure for specific personality characteristics (Markowitsch, 2002). Overviews of the results in this discipline are given by von Cramon (1998) and Karnath & Thier (2003).
- 5.2. **Vegetative symptoms:** Vegetative symptoms such as heart rate, blood pressure, galvanic skin response, etc. often are considered as superficial symptoms, because they can be measured on the body surface. On the other hand, these symptoms are also a “window” to the brainstem, because they are often generated in brainstem-structures, just as other central neuronal functions (central regulation of breathing and body temperature, swallowing reflex, sleep-wake-rhythm and deep sleep/REM-sleep-rhythm). Vegetative symptoms, in the sense of an increased sympathetic tone, indicate an arousal that dominates many emotions, but are unspecific in reference to a *certain* emotion. So far a vegetative symptom – also over the course of time – or a combination of vegetative symptoms – could not successfully be correlated with a *certain* emotion.
- 5.3. **Brain activity:**
 - a) For ethical reasons, *direct stimulation* of human brain cells is only possible in very rare cases. Methodically, the brain can be accessed either stereo-tactically or during necessary brain surgical interventions. Stereo-tactic stimulation is mostly used in diagnostic routines; only recently was it tentatively applied in treatment of major depression (Schlaepfer & Lieb, 2005). In epilepsy surgery, specific adjacent cells or brain areas are stimulated to check surgical possibilities with regard to reduction of epileptic seizures, and to check which vital centers should not be affected during surgery. Statements about basic human emotions did not derive from these surveys
Animal experiments lead to the hypothesis that rats have four basic emotions (Ekman, 1992a). Further studies must show to what extent these findings are transferable to humans.
 - b) Earlier, Berger, the inventor of the human electro-encephalogram (EEG), hoped to find correlates of psychological functions with his method (Berger, 1929). The EEG became an elementary diagnostic tool for neurological questions, but, in its basic form, it did not allow a correlation with complex brain functions like emotions.
 - c) Processed EEG-like *event-related potentials* allow correlations with psychological functions, such as attention and stimulus discrimination (N2- and P300-wave), but no precise correlations interact with emotions.

- d) By a *spectral analysis of EEG* (analysis of the relative strength of different frequency bands), a hypothesis about basic emotions could be developed (refer to Machleidt, 1993).
- e) Another EEG-based method is *polysomnography*. It measures the cerebral electric activity during sleep and allocates it with wake state, REM-sleep and sleep stage 1-4 (Rechtschaffen & Kales, 1968). Statistically, it allows the correlation with certain diseases. For example, depression is characterized by a reduced time between falling asleep and the first REM-phase (REM-latency) and generally a dis-inhibition of REM-sleep. From enhanced REM-activity a hyperactivity of the cholinergic system can be deduced (cholinergic-aminergic imbalance model; Hobson, McCarley & Wyzinski, 1975).
- f) With *magnetoencephalography (MEG)*, brain parts are magnetically stimulated, so that the bio-electric charge is changed temporarily. This stimulation so far has led to no consistent results about involvement of certain brain areas in certain emotions.
- g) *Functional magnetic resonance imaging (fMRT)* can measure certain brain areas with magnetic stimulation. (When the stimulated protons fall back to their initial energy level, they emit energy quanta, which can be measured and processed to an image.) The higher the magnetic field strength of the instrument, the better the statements one can make about a certain area. A field strength of 4 tesla makes it possible to form an opinion about an area (voxel) with a edge length of 0.7 cm. That makes it possible to assess the hippocampus, for example. *fMRT* allows us to form opinions about different aspects of the examined brain tissue: for example, the neuronal density in the examined tissue correlates with the amplitude of the n-acetyl-aspartate-peak.
- h) *SPECT* (single positron emission tomography) and *PET* (positron emission tomography) are methods that measure radioactive marker-substances in the brain. Because of lower resolution, *SPECT* is less applicable for the examination of small brain areas. *PET* can measure radioactive marked glucose in the brain. Because the glucose-metabolism is increased during every neuronal activity, the activity of a certain brain area can be deduced from the intensity of the radioactive enrichment in that area.
- i) Usually *transmitters* cannot be studied directly. So far research has not succeeded in associating the general effect of a certain transmitter with a certain emotion.

In this context, it is interesting to note that depressive patients have a relative increase of acetylcholine in proportion to aminergic transmitters (noradrenaline), as sleep-EEGs indirectly show. Polysomnography shows a reduced time between falling to sleep and the first REM-activity (shortened REM-latency) and generally an increase of REM-sleep-time with increased intensity of eye movements during REM-sleep. As REM-activity is connected with a domination of cholinergic transmission, a relatively increased acetylcholine activity in depression can be deduced (model of cholinergic-aminergic imbalance; Hobson et al., 1975; also refer to Riemann et al., 2001; Berger et al., 2003). But a predomination of cholinergic activity can at the most be a link in the pathogenetic chain. Several other transmitters in different cerebral regions can be involved in depression. The cholinergic-aminergic imbalance is a state-marker, but not a trait-marker.

Depression, in comparison, is a complex group of conditions; the main symptoms are dejection, lack of motivation, constricted thinking and, sometimes, inadequate ideas of guilt, impoverishment, worthlessness up to depressive delusion. Berger (2004) gives an overview of the state of the art on depression.

An exception is possibly the transmitter serotonin. The cerebral serotonergic system begins in the brain stem (nucleus raphe), spans over all other neural networks and releases serotonin in a regular rhythm (3-5/sec. during the day, 1-2/sec. in the night, interrupted during REM-sleep). The serotonergic system seems to synchronize and harmonize other neuronal networks. The intake of carbohydrates as well as the absence of food causes a release of serotonin in the brain. The drug 'ecstasy' releases serotonin all at once. The conclusion was that an increased serotonin activity in the brain has a euphorogenic effect. But one has to consider that the influence of a certain transmitter on a neuronal network potentially involves complex processes in other transmitter systems, which can cause the observable effect.

- j) *Psychotropic drugs* give an indirect clue. Stimulants generally heighten motivation and mood; sedatives can sedate the mood, especially obsessive forms of euphoria, or brighten up (for example, depression with strong anxiety symptoms). Many patients with depression (primarily of organic origin, or primarily due to an abnormal perceptual reaction) experience a heightened mood when they take antidepressants. Different antidepressants affect different transmitter systems; some substances affect several transmitters simultaneously, and they can affect many different cerebral areas. Moreover, antidepressants do not have an instant effect, but have a latency; probably because of the effect of primarily triggered transmitters on so-called second messengers in the neurons. Also, feeling low is only one symptom of depression. Therefore the effect of the mentioned drugs does not imply that defined cerebral structures are involved in emotions: – The same goes for neuroleptic drugs.
- k) *Genetics*. There is a genetic disposition for fear behaviour (Marks, 1987). Identical twins that grew up in different environments are much more alike in terms of anxiety than two non-identical twins (Kagan & Snidman, 1991). Fear, phobia and obsessive-compulsive disorder occur more often in families; and more often both identical twins than non-identical twins are affected.

Epistemological note

The evidence of a positive correlation indicates a causal connection, but does not state anything about the direction of the causality. This is not always considered in psycho-biological correlations. If psycho-biological correlations are found, it is frequently taken for granted that the biological factor is the cause and the psychological factor the effect. Proof or plausibility for the direction of causality must always be given.

Basic emotions

Which theories do we have about basic emotions? Some questions are especially interesting: Is it plausible that there are a distinct number of basic emotions? And if so, which ones? If there are diverging theories about the number and nature of basic emotions, is it possible to bring them down to a common denominator? Below some well-founded theories are listed:

- 1) Several research teams found a universality of emotional *expression*: Mimic expression and/or expressive body movement for certain emotions are transculturally the same or alike and differ from other emotions. On this basis, Tomkins (1962) stated eight basic emotions: astonishment, interest, pleasure, anger, fear, aversion, disgust, shame, pain, sorrow/distress. Izard (1992a & b) also found eight basic emotions, while Ekman (1984, 2004) described seven basic emotions: surprise, pleasure, anger, fear, disgust, grief &

contempt. Paul Ekman relies on decades of personal research, among others, in tribes in New Guinea that at the time had had no contact with other civilizations.

- 2) Plutchik (1980, 1993) and Frijda (1986) categorize basic emotions according to *action tendencies* (not only mimic movements) that correlate with emotions. Plutchik concludes a system of eight basic emotions: sadness, disgust, anger, anticipation, joy, acceptance, fear, surprise. – Around these basic emotions Plutchik clusters secondary and tertiary emotions (for example he names the combination of joy and anticipation as “optimism”, the combination of fear and surprise as “awe”; see fig. 1)

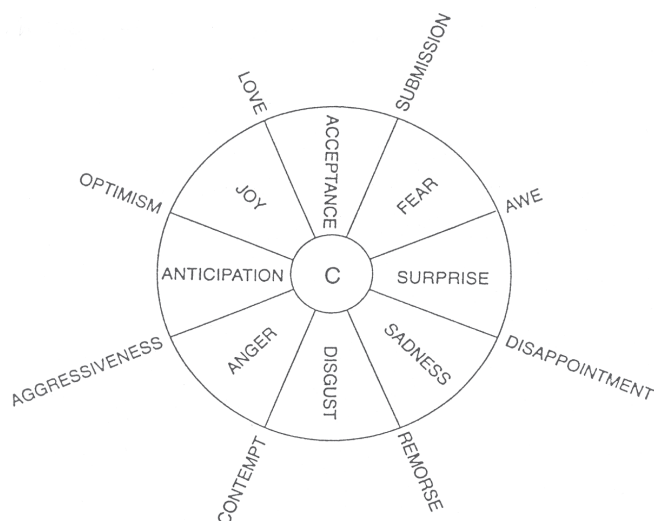


Fig. 1: Basic and composed emotions according to Plutchik (1980)

- 3) Some teams used *linguistic methods* to examine to which extent word fields are specific for certain emotions or overlap. Johnson-Laird & Oatley (1992) found five basic emotions: happiness, anger, fear, disgust, and grief.
- 4) The team of Machleidt (Hinrichs & Machleidt, 1992; Machleidt et al., 1993; Debus et al., 1994) used an original approach. They used *EEG* on test persons while those felt different emotions. The brain-electric activity was analyzed by spectral analysis in the underlying frequency bands (mathematically by Fast fourier transform). Five clusters were found and could be correlated with the following emotions: Interest/“hunger”, anguish/fear, aggression, grief, and pleasure.
- 5) The approach of Jaak Panksepp can be considered as psycho-biological basic research, because it is based on *direct brain stimulation*. Panksepp (1982, 1998) examined the behaviour patterns that resulted from stimulation of certain areas in rat brains. He found four distinct reaction patterns, which the rat also showed in other situations and which he identified as panic, anger, anticipation and fear.

Certainly the advantage of this approach is that it is based on the reaction to direct stimulation of cerebral neurons. One could critically ask: Can we attribute an emotion like fear or anger to a rat? From a behaviourist point of view one would probably answer something like: *We call a certain behaviour “fear”, when it serves the avoidance of a certain situation und is accompanied by defined, measurable vegetative phenomenon. And we can*

measure if this behaviour (i.e. the so-defined fear) occurs or not. – Such an argumentation would ignore the question whether the rat has an emotion (for example, fear) in the sense of “inner” experience. The advantage is the comparability of animal and human behaviour. The disadvantage is that, in my opinion, the question about emotions in the sense of inner experience is especially interesting and is not answered in such an animal experiment.

- 6) Through clinical observation and statements of his patients during an emotionally charged experiential process in Bonding Psychotherapy (New Identity Process), Casriel (1972) found five basic emotions: fear, anger, pain, love, and pleasure. This statement is based on sheer clinical observation and the theory seems to need some support. But it can be granted that this form of psychotherapy can guide people to express and feel their strongest (and according to subjective evidence, their deepest) emotions. (Details on Bonding Psychotherapy, see below)

The *current theories about basic emotions* can be summarized as follows: The concept of basic emotions in contrast to complex or derived emotions is still valued and has engaged growing interest during the last years. At this time there is no full consent about number and nature of basic emotions. But in current scientific discussion, there is a significant convergence concerning the development of theories about the nature and number of basic emotions. In the literature that was evaluated and summarized for this article, only research papers can be found that state there are not less than four and not more than eight basic emotions. All theories agree that the following emotions belong to the basic emotions: Fear; anger/rage; pleasure/happiness; grief/pain (see Chart 2 below).

An exception is the approach of Panksepp, who found no equivalent for grief or emotional pain in stimulation of rat brains. The question remains unanswered whether the attributed emotion “anticipation” can be correlated with human “pleasure”.

	Number of basic emotions		
Plutchik (2002)	8	<ul style="list-style-type: none"> • approval/acceptance • fear • astonishment • grief 	<ul style="list-style-type: none"> • disgust • anger/rage • anticipation • joy/pleasure
Casriel (1972)	5	<ul style="list-style-type: none"> • fear • anger • pain 	<ul style="list-style-type: none"> • love • pleasure
Johnson-Laird & Oatley (1972)	5	<ul style="list-style-type: none"> • happiness • anger • fear 	<ul style="list-style-type: none"> • disgust • grief
Ekman (2004)	7	<ul style="list-style-type: none"> • astonishment • pleasure • anger • fear 	<ul style="list-style-type: none"> • disgust • grief • contempt
Tomkins (1962)	8	<ul style="list-style-type: none"> • astonishment • interest • pleasure • anger 	<ul style="list-style-type: none"> • fear • disgust • shame • pain

Chart 2: Basic emotions – different systems

Fear as example

Probably the best-researched basic emotion is fear. Fear is relatively easy to define and everybody seems to know it. Fear shows rather clearly in behaviour. There seems to be a sufficiently good animal model. Therefore fear was a good emotion for research; the neurobiological pathways are established. We follow the description of LeDoux (1998, chap. 6). The important switch points are the sensory thalamus, the amygdala, the sensory cortex and the hippocampus (Fig. 2).

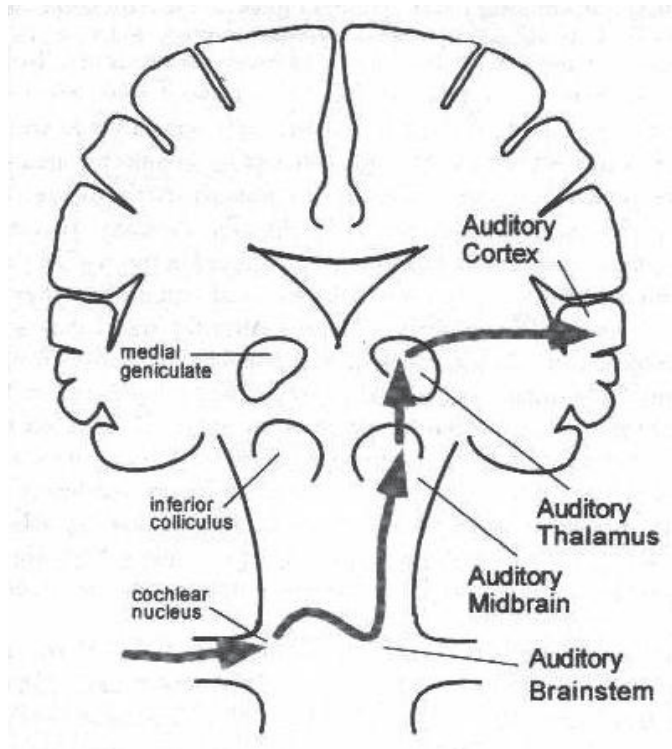


Fig. 2: Pathways of the basic emotion fear (LeDoux, 1996)

An emotionally activating stimulus reaches the sensory thalamus via the sensory organs. From there the stimulus passes a primary neuronal connection (“lower pathway”), a fast circuit, to the amygdala. The amygdala controls the emotional response: flight or fight or freeze, or an analog vegetative response, and is especially activated with persons with traumatic stress (van der Kolk et al, 1996). If the stimulation is stronger, an additional higher pathway in the sensory cortex is activated. Here the stimulus also passes the sensory thalamus and the amygdala and leads to the emotional response. The difference to the lower pathway is firstly, that the response time is longer due to the more complicated multiple circuits and secondly, that a higher cerebral region is involved. If the charge by the stimulus is even stronger, an even higher pathway, via the hippocampus, is activated (a cerebral structure with central importance for memory), and also cortical structures (fig. 3). For neurobiological pathways concerning recognition of emotions: see fig. 4.

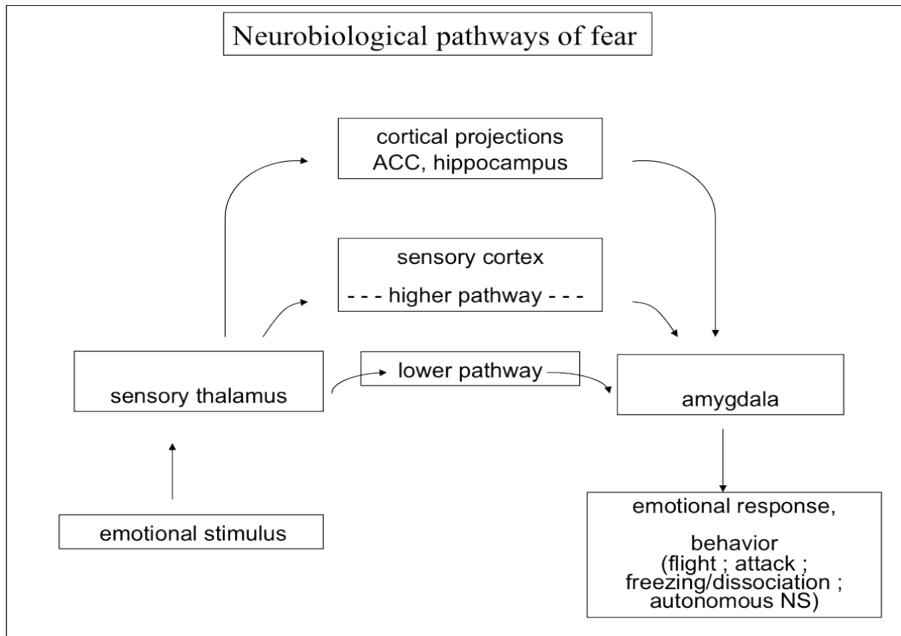
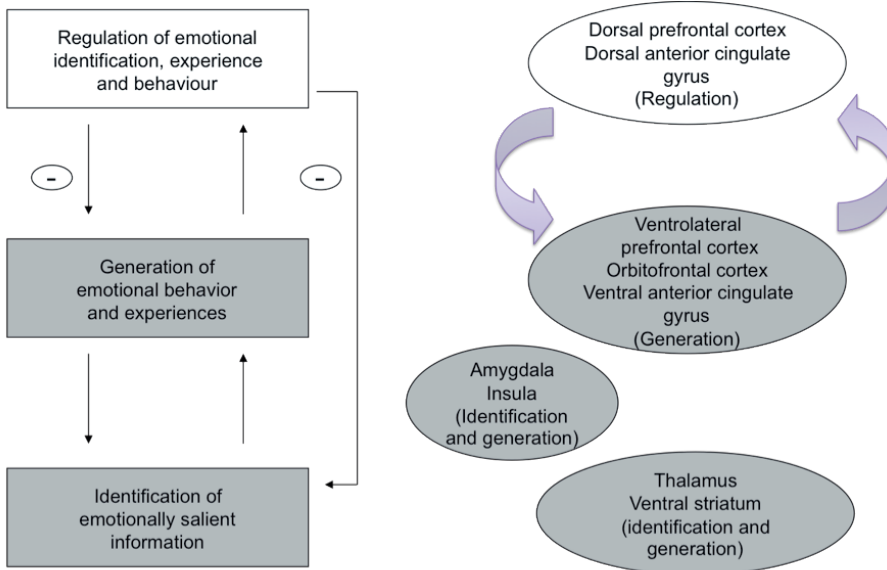


Fig. 3: The pathways of emotional processing

We take these well-researched neurobiological processes as starting point for our two hypotheses.



Phillips M. L.: Brit. J. Psychiatry, 2003

Fig. 4: Recognition of emotions and associated neurobiological structures

Hypothesis about the neurobiology of attitude work

“Attitudes” as core beliefs direct the perception of a person. Quite in a constructivist sense, such an “attitude” determines how a person perceives the world, including himself/herself. Such core beliefs determine styles of thinking, basic affective hue, and therefore interaction and action. The work with such core beliefs has been and still is part of many psychotherapeutic methods, for example gestalt therapy, transactional analysis, cognitive therapy, scheme therapy. Psychoanalysis tries the same, working with resistance and projection.

“Attitude” is seen in Bonding Psychotherapy not as fluffy positive thinking or motivational boost, but as a fundamental conviction of a person. For those life-guiding convictions, the English term “stance” or the German “Haltung” are also appropriate.

Without going further into the indications of the different forms of psychotherapy, the opinion seems widely accepted that a core belief can not change without emotional reassessment. Greenberg also advocates this with his “emotionally focused experiential approach” (Greenberg & Rice, 1993; refer to Strauss 2005, see also Stauss & Ellis, 2007). *Attitude work* in the sense of Bonding Psychotherapy, going back to Casriel (1995) can be described as follows.

In attitude work, it is fundamental to identify the core belief that so far has directed life (and perception). If this is successful, there are basically two possibilities:

- a) The patient deliberately activates the previous (destructive) attitude and, while holding eye contact, expresses it in front of a number of other patients, expressing the sentence with increasing intensity of voice and accompanying body expression. Then a switchover occurs: The patient realizes with subjective evidence that the old pattern, the old attitude can not be maintained here and now in the interactive dyad, because the lack of coherence is experienced too strikingly. More precisely: the old attitude stays steadily conscious, while with growing intensity of the emotional (phonetic and motoric) expression also the cognitive-affective dissonance increases, so that the absurdity of the old belief is clearly experienced *in the present*. Then the attitude switches over to a new belief. When we start with the old (destructive) attitude, it is important to guide the patient towards this switchover and to a new attitude during the therapy session.
- b) The patient begins with the new attitude. From what has been said so far, it is clear that the new attitude feels strange to the individual patient (because it diametrically contradicts the old belief). An example of a destructive core belief is: “I am wrong.” A new attitude would be, for example: “I am OK as I am.” (It is part of the therapeutic art to find the exact new attitudinal sentence with the patient. This cannot be a mechanical process, because every person feels and experiences different connotations for the same words.) For a more detailed description of attitude work, refer to Stadtmüller (2005).

In attitude work the emotional charge is increased by intensity of voice and body expression. At the same time flight, fight and freeze are prevented by the context of this therapy. The consequence is that emotional loading increases.

Our hypothesis is that the loading of the sensory thalamus emanates with such intensity that the higher pathways get involved – even more so, as the previously adequate “old response” in the sense of flight, fight or freeze is not possible in the therapy situation. This leads to involvement of the hippocampus und the corresponding cortical projections (Fig. 5). This again has two consequences:

The old attitude becomes explicitly conscious. It is often in this state that biographical memories that had been chronically hidden spontaneously come to the surface.

Our hypothesis states that activation of the hippocampus and the following cortical projections cause an “openness” for new engrams, in the sense of a new attitude, a new conscious semantic, grammatical and contextual information that is more strongly anchored, because the emotion is stronger.

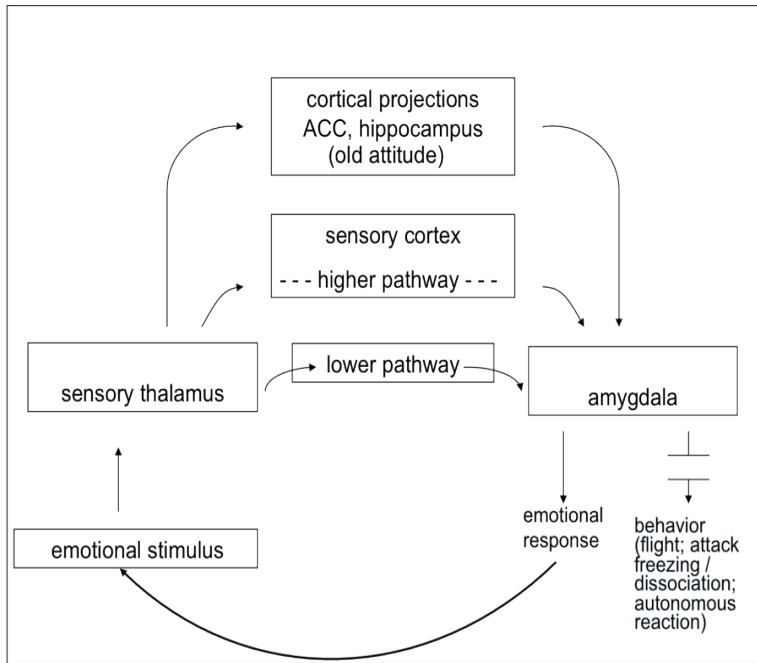


Fig. 5: Neurobiological changes during Bonding PT:
 Enhancing emotional expression and blocking of acting out (aggression, flight, dissociation)

According to our hypothesis, the following processes regularly occur: (1) Charging of higher pathways to the sensory cortex and hippocampus; (2) the old attitude becomes conscious; (3) “competition” between old and new attitude occurs; and (4) an anchoring of new contextual information happens that is associated with intensive emotion. (Fig. 6)

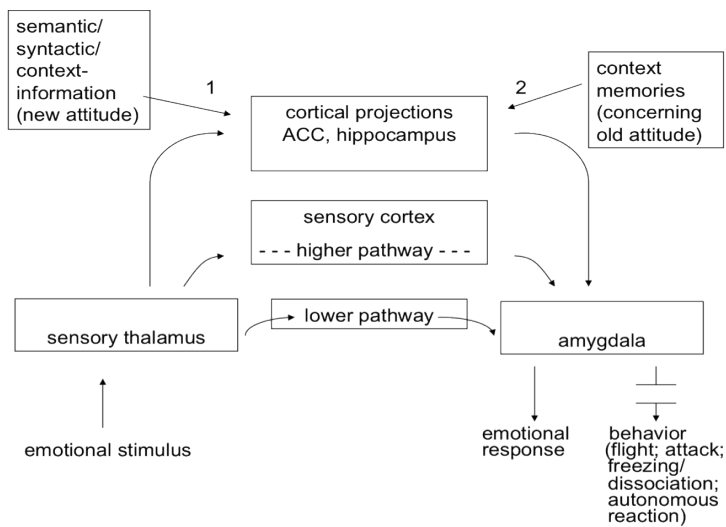


Fig. 6: Neurobiological changes during Bonding PT: attitude work

This leads to an overload of the emotional circuit as mentioned above. When the highest pathway of emotional processing is loaded, it is possible:

- 1) to give the input of a new semantic/syntactic and sometimes context information (new attitude), that is antithetical to the old destructive stance.
- 2) The new attitude of course feels strange to the individual because it contradicts the inner working model. A high emotional intensity (full body expression) leads to a – sometimes sudden – emotionally focused experience. The individual may get conscious of the old attitude as such, i.e. the old attitude suddenly may be perceived as a defence and not as a correct view of the (external and inner) world. Quite often there is sudden pain, remorse or shame for a short time, then joy to go with the newly internalized attitude.

Hypothesis about the neurobiology of the Bonding Exercise

Julia Gordon (2005) defines Bonding Psychotherapy as follows: “Bonding Psychotherapy is a method to be aware of emotions and to express them in close physical contact (bonding). This method quickly activates underlying dysfunctional patterns in interpersonal relations. It allows the participants to work through emotions and attitudes. It catalyzes a process towards the adoption of constructive attitudes by providing the experience of deep emotions in a safe and holding environment. (“I feel pain *and* I experience a soothing secureness in close contact.”) – In addition, the safe atmosphere in the group allows a corrective experience. (“I am accepted with all my intensive emotions.”)

For a description of Bonding Psychotherapy, called New Identity Process by its founder Daniel Casriel (1995), refer also to Dennler (1996), Wehrli (2005) and the fundamental work by Stauss (2006). When bonding practice is conducted in close physical contact, the patient is encouraged to express the rising emotions while he/she is being held by another patient.

A clinical example: A man came to therapy with a tendency towards anger and dominance that was a problem, but was also of unknown origin for himself. While he was expressing his anger on the highest level in Bonding Psychotherapy, for the first time he remembered a situation when he was three years old and his mother was ill and bedridden after another birth. The 3 year-old boy experienced that his mother was not available as a cheerful playfellow anymore, but had to be taken care of herself. He remembered the anger about the absence of the mother as he knew her and the simultaneous suppression of his anger because of his fear for the beloved mother. Not only did he have a vivid memory, but he re-experienced the situation from the perspective and with the physical sense of the 3 year-old boy. In this case, the clear memory from the third year of his life was verified by the patient, when decades later he asked his mother if there had been anything special when he was three years old, and then she told him about her illness – which the patient had remembered in therapy, but never before. This therapy helped him to develop, not only an insight into the origin of his tendency, but also new inner levels of freedom from being at the mercy of his own anger. He became able to distinguish and decide about when, and to what extent, he wants to express his anger.

Building on the well-supported physiological pathways of fear, we formulate neurobiological hypotheses as well for this emotional activation: In the process, intense physical expression and high emotional loading occur, especially by loud expression i.e. screaming out of emotions. At the same time flight, fight and freeze, as ways to reduce the emotional intensity or to leave the situation, are not possible. It is essential that the therapeutic closeness is experienced as protective. In a sense Bonding Psychotherapy is the opposite of isolation. Through the emotional expression, the lower direct pathway between

the sensory thalamus and the amygdala gets overcharged, with the consequence that the higher pathway which involves the sensory cortex is activated. Our hypothesis is that this pathway gets temporarily overcharged, so that the pathways from the sensory thalamus to the hippocampus and projective pathways to the neo- and parietal cortex are activated. This leads to an activation of the contextual and explicit memory in connection with the contents linked with the emotion from early years. Then several conscious connotations of a key emotion, for example fear, become more than obvious (and probably unconscious connotations or those stored in body memory as well). Now a corrective experience can take place, in the sense that the maximal affect is experienced with the old key memory, while at the same time the experience in the bonding situation is not dangerous, but safe (even protected), permitted, affirmed and approved in the contact (fig. 7).

Therefore the following happens:

- consciousness about (stored) fear,
- awareness about a new reality (being close *and* protected)
- conscious knowledge about the old *and* the new fear,
- evidence that the current situation has a different emotional meaning than the situation from the past (in the language of many patients: “Now is not back then!”); with this a reversal of projections can suddenly take place.

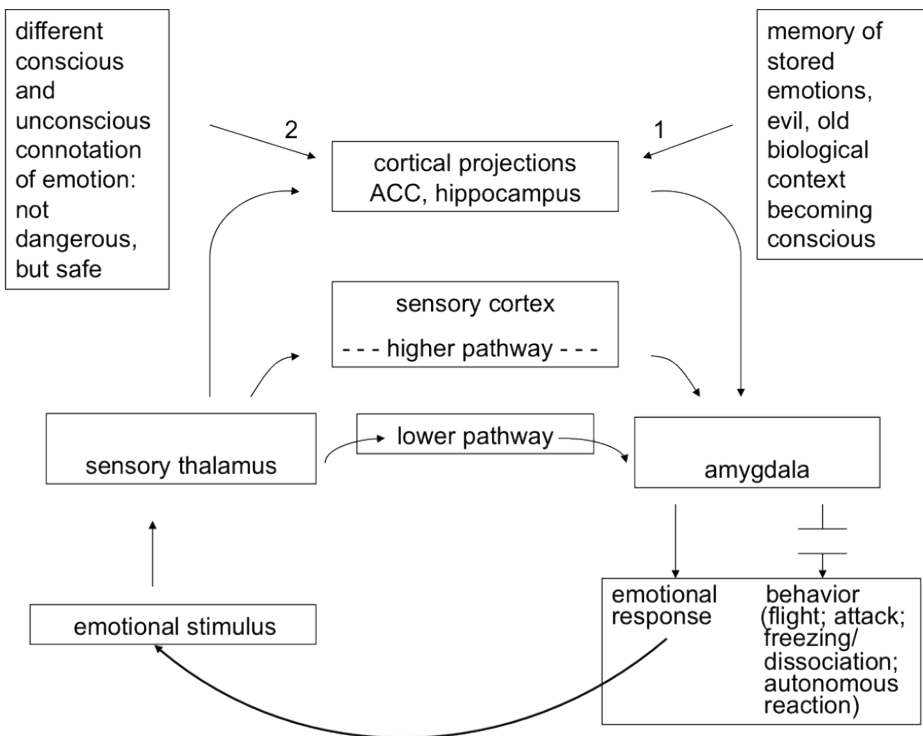


Fig. 7: Neurobiological changes during Bonding BP Exercise

Overloading of emotional circuit opens the highest pathway via ACC and cortical projections. This: 1) brings to surface stored emotions that are basic for the individual and often are blocking progress. Quite often forgotten biographical data, e.g. of traumatic events, that are

combined with these emotions become conscious; and 2) an antagonism between different connotations and meanings of these emotions take place, sometimes with the intensity of an inner struggle. In this period of the therapy it is essential that the individual feels safe and protected so that he/she can work through that struggle to succeed in giving the old emotion a positive connotation, thus reframing the situation.

Practical conclusions

Emotions are the major source of *energy* for change in psychotherapy, while on the other hand the *direction* of change is not given by the emotion itself. It makes sense to focus on the *basic emotions*. Concerning these, there are still differences of opinions in academic discussion, but the following basic emotions can be taken as common ground: fear, anger, grief or emotional pain, pleasure.

In therapy it is vital to acknowledge *all* these emotions in their worth. If the experience of anger from others or from ourselves is connected with very strong fear, usually one of two problems is present:

Confusing of anger and violence: If anger generally is experienced as a threat of violence, this not only leads to an increased fear level but also to the tendency to consciously or unconsciously devalue ones own anger and with it eventually the possibility for self-assertion.

Confusing of anger and hate: If hate is understood as a combination of a basic emotion (anger) and a tendency (the wish to injure or kill), then one task of therapy can be to enable the patient to understand and experience this difference – with the goal that the patient can affirm the anger part for himself/herself (and for others).

Our neurobiological theses about attitude work and Bonding Psychotherapy explain why a high emotional loading is necessary to change conscious and half-conscious engrams and to revoke projections.

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