



## Discussion on Otto Kernberg's presentation from the point of view of a neuroscientist

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**Abstract.** The psychoanalytic affect theory is discussed in the light of (a) the theory of evolution, (b) the participation of implicit (procedural) memory in the establishment of “learned fear” and (c) the major conclusions of cognitive psychology. © 2005 Published by Elsevier B.V.

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I start this discussion by quoting what Sigmund Freud wrote in his essay *on Narcissism* 90 years ago: “we must recollect that all of our provisional ideas in psychology will presumably one day be based on an organic substructure”.

Besides Freud I would like to introduce in this discussion Charles Darwin, not only because he conducted one of the first extensive studies on emotional expression [1], but also because his ideas suggesting that human behavior is a result of evolutionary processes, were to my opinion, the theoretical basis of experimental psychology. To my opinion, William James's thinking was influenced by Darwin's theory of evolution. Furthermore the idea of evolution is of extreme importance for what we discuss here today. Because, par example, the argument of Dr. Kernberg: “from the viewpoint of psychoanalytic theory, the genetically determined and constitutional given capacity to react affectively to bodily and environmental stimuli, with separate affective systems for pleasurable and aversive affect development, indicates the biological basis for the overall classification of the affective system into positive or rewarding and negative or aversive affects”, becomes stronger if we consider that such capacities are selected during the aeons of evolution of the different species.

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Let us consider now the following phrase from Kernberg's presentation: "In summary, while the frontal areas, the prefrontal and preorbital cortex are the planning cortex areas related to the working memory that integrates affects and perception of the present environment of the organism, the amygdala is central in generating affects, particularly negative affects that dominate in psychopathology, and through its connections with cortex and hippocampus, leads to the storage of affective memory". Amygdala is a complex of nuclei, the basolateral and corticomедial nuclei and the central nucleus. Afferents to the amygdala come from a large variety of sources including neocortex, hippocampal and cingulate gyri. Information from all sensory systems feeds into the amygdala, particularly in the basolateral nuclei. Each sensory system has a different projection pattern to the amygdala nuclei, and interconnections within amygdala allow the integration of information from different sensory systems. Two major pathways connect the amygdala with the hypothalamus, the ventral amygdalofugal pathway and the stria terminalis.

A number of different experiments suggest that neurons in the amygdala can memorize stimuli associated with pain. In an experiment rabbits were trained to associate the sound of a tone with mild pain [2]. The researchers made use of the fact that a normal sign of fear in rabbits is a change in heart rate. Animal was placed in a cage, and at various times would hear one of two tones. One tone was followed by a mild electrical shock to the feet through the metal floor of the cage, the other tone was benign. After training, it was found that the rabbit's heart rate developed a fearful response to the tone associated with pain, but not to the benign tone. Prior to training, neurons in the central nucleus of the amygdala failed to respond to the tones used in the experiment. However, after training, neurons in the central nucleus responded to the shock-related tone but not to the benign one.

Joseph LeDoux has shown that after this type of fear conditioning, amygdala lesions eliminate the learned visceral responses, such as the changes in heart rate and blood pressure. LeDoux has proposed a circuit to account for memorized fear. Auditory information is sent to the base lateral region of the amygdala, where cells in turn send axons to the central nucleus. Efferents from the central nucleus project to the hypothalamus, which can alter the state of the autonomic nervous system, and to periaqueductal gray matter in the brain stem, which can evoke behavioral reactions via the somatic motor system [3].

Thus, the central nucleus of amygdala can induce fear and anxiety responses not only in the presence of the painful stimulus but after recall of the painful stimulus induced by an associated stimulus. Central nucleus also projects to cortical association areas, especially the orbitofrontal cortex and the cingulate gyrus and this pathway is important for the perception of the emotional experience. However, this experience has to be distinguished from what is happening inside the central nucleus. The memory that is established there, the cause of autonomic, motor and conscious reactions, does not reach the level of the explicit (declarative) memory, it is an unconscious, implicit (procedural) memory. An unconscious, but not repressed, memory.

In implicit memory, then, we have a biological example of one component of unconscious mental life. How does this biologically delineated unconscious relate to Freud's unconscious? In addition to the repressed parts of the ego Freud proposed that still another part of the ego is unconscious. Unlike the unconscious parts of the ego that are

repressed and therefore resemble the dynamic unconscious, the unconscious part of the ego that is not repressed is not concerned with unconscious drives or conflicts.

According to Eric Kandell, “the unconscious part of the ego that is not conflicted or repressed appears to map onto what neuroscientists call *procedural memory* and . . . that many of the changes that advance the therapeutic process during an analysis are not in the domain of conscious insight but rather in the domain of unconscious procedural (nonverbal) knowledge and behavior. To encompass this idea Sanders, Stern and their colleagues have developed the idea that there are *moments of meaning*—moments in the interaction between patient and therapist—which represent the achievement of a new set of implicit memories that permits the therapeutic relationship to progress to a new level” [4]. The significance of procedural memory for the development of psyche is also recognized by Otto Kernberg by saying: “one other implication of these formulations is that the deepest layers of psychic experience that will organize the psychic apparatus are represented by peak affect states of a positive or negative quality, in the context of which the deepest aspects of the relationships between self and others are internalized, presumably at first into *procedural memory*, and only later on in the form of *declarative or preconscious memory*”.

Another extremely interesting aspect is raised by the following part of Otto Kernberg presentation: “Transference focused psychotherapy (in borderline patients) improved reflective functioning, that is, a significant increase in the capacity for differential conceptualization of self and object representations, an awareness of mental experiences in the self and the others and the capacity to reflect about them. This specific effect of psychoanalytic psychotherapy was accompanied by an increased capacity to maintain cognitive sets and a reduction of impulsivity in carrying out motor tasks evaluated by neuropsychological tests illustrating specific neurobiological effects of psychoanalytic psychotherapy”. These impressive, indeed, results of transference focused psychotherapy can be very well explained by the following major conclusions of cognitive psychology:

- The internal representation of personal space is modifiable by experience.
- Experience changes not only several aspects of brain function but also brain’s architecture.
- These distinctive modifications of brain architecture and function, along with a unique genetic makeup, probably constitute the biological basis of individuality.

Eric Kandel in his well known article under the title A new intellectual Framework for Psychiatry [5] writes: “insofar as psychotherapy or counseling is effective and produces long-term changes in behavior, it presumably does so through learning, by producing changes in gene expression that alter the strength of synaptic connections and structural changes that alter the anatomical pattern of interconnections between nerve cells of the brain. As the resolution of brain imaging increases, it should eventually permit quantitative evaluation of the outcome of psychotherapy”.

Thus, I would like to conclude this discussion by saying that brain architecture can be modified by experience and such modifications of brain map may contribute to the biological expression of individuality. The structure of human brain, although limited by the general framework of the genetic material, is continuously under reform by the

experience and by the activity of the brain itself. It can be suggested the paradox that one characteristic of the evolution of the human species is the selection of genes that permit to “escape” from them, in the sense that they give the possibility of considerable plastic changes of brain architecture and presumably human behaviour. Therefore the structure of our brain is a result of our personal history and our mind is not confined in the form of inflexible networks. On the contrary, our mind is a historical, cultural and social phenomenon.

Two thousand years ago Hippocrates said: “*Men ought to know that from the brain, and from the brain only, arise our pleasures, joys, laughter and jests, as well sorrows, pains, griefs and tears. . . .*”

If Hippocrates lived today he might added: “*Pleasures, joys, laughter and jests, as well as sorrows, pains, griefs and tears produce brain on the other hand*”.

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