British Journal of Psychiatry (1991), **159**, 97–105

Affects as Central Organising and Integrating Factors
A New Psychosocial/Biological Model of the Psyche

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A new psychosocial/biological model of the psyche is proposed, in which the affects play a central role in organising and integrating cognition. The psyche is understood here as a complex hierarchical structure of affective/cognitive systems of reference (or 'programmes for feeling, thinking, and behaviour'), generated by repetitive concrete action. These systems store past experience in their structure, and provide the functional basis for further cognition and communication. Affects endow these programmes with a specific qualitative value (such as motivation), connect cognitive elements synchronically and diachronically, and contribute to their storage and mobilisation according to context. They also participate in differentiating cognitive systems at higher levels of abstraction. These assumptions are supported by recent findings on the role of the limbic and hypothalamic system for the regulation of emotion, on neuronal plasticity, and on the phenomenon of state-dependent learning and memory. Refutable hypotheses are formulated for further research on the interaction of emotion and cognition.

During recent years, psychiatric research has made considerable progress in both biological and psychosocial directions. However, with the increasing sophistication of each specialty, the danger of unilateral reductionism is correspondingly increased. Several current approaches, particularly the general 'bio-psycho-social model' first formulated by Engel (1977), attempt to counteract this danger, although precise ideas about the interaction between psychological, social, and biological elements are still lacking. This paper discusses such ideas, based on a selective survey of recent findings in these three disciplines. These ideas aim to clarify the interplay between affective and cognitive phenomena on the one hand, and intrapsychic and social phenomena on the other, through a synthesis of convergent psychodynamic, sociodynamic, and neurophysiological findings, formerly elaborated in the concept of 'affect logic' (Ciompi, 1984, 1986, 1988*a*,*b*, 1989). Some of the relationships postulated in these earlier studies appear to have been at least partly confirmed on the biological level, thus providing a possible basis for the tentative formulation of a new, inclusive three-level, functional model of the psyche.

The overall conceptual framework is taken from general systems theory and cybernetics (Wiener, 1948; Shannon & Weaver, 1949; von Bertalanffy, 1968; von Förster, 1968; Miller, 1969, 1975). This includes modern theories of the dynamics of complex, non-equilibrium, self-governing systems (related to the concept of 'dissipative structures') and chaos theory (Prigogine & Stengers, 1981; Nicolis & Prigogine, 1987; Gleick, 1988). Other basic concepts include the concepts of autopoiesis (self-regulation) and structural coupling between self-containing and self-regulatory phenomenological domains, such as neuronal processes, outward behaviour, and conceptualisation by an observer; these have been elaborated by Varela (1979) and Maturana (1982). The concept of a 'domain of psychic phenomena', introduced by the present author in 1986, and analogous to the above, is also basic to the proposed model.

The first two sections below present an outline of the relationships between psychological, social, and neurophysiological phenomena that have been discussed in detail elsewhere (see above). The third section reports biological findings that support the resulting three-level model of the psyche.

Relationships between psychological, social, and biological phenomena according to the concept of 'affect logic'

The concept of 'affect logic' is based on hitherto insufficiently acknowledged findings which are common to cognitive psychology and psychodynamics (especially genetic epistemiology and psychoanalysis), showing that emotion and cognition (or feeling and thinking, affect and logic) never occur in isolation, but are always closely combined (Freud, 1895, 1905, 1911; Rapaport, 1950; Gressot, 1955; Piaget, 1981). The concept is also based on the discovery by Piaget that cognitive structures originate in innate sensorimotor 'schemata', which gradually differentiate during childhood through assimilatory/accommodatory interactions with reality, and thus constitute a 'condensation of action' or of concrete experience (Piaget, 1972, 1976, 1977). Consequently, the relationship of cognitive structures to the environment, and in particular to all important interpersonal transactions, necessarily become part of the slowly forming intrapsychic structures. Simultaneously, these become increasingly automatic, internal, and mental.

Since every action contains emotional elements and is ultimately regulated by the pleasure principle (Freud, 1911, 1926), specific affects, positive or negative, are assigned to specific cognitive contents (e.g. persons, objects, places, situations, concepts). The presence of particularly strong or often repeated affects in similar circumstances lead to a remarkably stable connection between certain cognitions and certain emotions. This 'affective constancy' (Piaget, 1981) forms the basis not only for simple conditioned reflexes (i.e. an infinite number of everyday patterns of behaviour) but also for complex 'transference' phenomena in the psychoanalytical sense.

Consequently, in the conceptualisation of 'affect logic', the 'psyche' is understood as a complex hierarchical structure, consisting not only of cognitive, but necessarily *affective* cognitive 'schemata' or 'systems of reference'. On all hierarchical levels, these systems of reference correspond to a synchronic condensation of repeated past actions: they are effectively operational 'programmes' of feeling, thinking and behaving, which store past experience in their structure and therefore represent probably the most important form of memory. At the same time, they provide a functional matrix for all perception and communication.

These basic concepts imply that close relationships exist between the psychological, social, and neurophysiological domains, as mental structures are conditioned by interpersonal processes and the biological substrate of the resulting operational 'programmes' probably consists of corresponding neuronal pathways established by repetitive actions according to the concept of neuroplasticity (see below). At the theoretical level, it is important to realise that affective cognitive systems of reference are indeed *systems* in the sense used in systems theory – they are complex entities formed by mutually interacting and equilibrating elements, as shown by Piaget (1976) for purely cognitive 'schemata'. As a consequence, the general principles of systems theory can also be applied to mental processes: the homeostatic (i.e. structure-maintaining) effect of negative feedback and the morphogenetic (i.e. structure-forming) effects of positive feedback are of particular interest. Under certain circumstances, the latter are presumably capable of provoking sudden non-linear jumps far away from equilibrium, leading to chaotic conditions or to the formation of new 'dissipative structures'.

Organising and integrating functions of affects in the psychosocial domain

Affects (or emotions, feelings, moods, etc. – terms covering overlapping phenomena with a common denominator (Ulrich, 1982; Euler & Mandl, 1983; Mandl & Huber, 1983)) can be defined for the purposes of this article as those phenomena in the psychic domain which are accompanied by peripheral bodily changes (e.g. sympaticotonic or parasympaticotonic effects on pulse, respiratory rate, blood pressure, tone of smooth and striated muscles). Thus, affects always involve the whole body, a notion which suggests a close relationship between 'affect logic' and psychosomatics. The *psychic domain*, on the other hand, can be defined as that class of phenomena which can be present in consciousness in certain circumstances, but are directly accessible only by introspection; these include moods, feelings, thoughts, representations, mental imagery, etc. Their presence in others can only be apprehended indirectly – by having them reported to us, or by reasoning by analogy from our observations – a fact which is often overlooked.

Evidence for the organising and integrating functions of affects comes, firstly from psychoanalytical observations, such as the assumption that, in meeting his/her basic needs, the initial organisation of the newborn's cognitive world comprises a distinction between an 'all-good world', containing the totality of pleasant experiences, and an 'all-bad world', containing all unpleasant experiences (Kernberg, 1976, 1980). Eventually, specific object representations and self-representations with both positive and negative connotations differentiate from these distinctions, through a complex affective cognitive process. However, similar organisations of cognitions can be observed in adulthood, as for instance in the 'condensation' of a large number of cognitive elements into higher classes of abstraction with similar emotional colouring (weed/useful plant, friend/enemy, etc.). Certain emotionally conditioned distortions of cognitive perception concerning social groups, such as whites or blacks, youngsters or old people, Jews or Arabs, which are well known in social psychology are also relevant here (Haisch, 1983).

Additional evidence of the organising functions of affects is provided by Grof's (1985) observation that individual experiences associated with the same kinds of affects (e.g. shame, fear, joy, anger), even if scattered over an entire life time, can be remembered *en bloc* under hypnosis or under the effects of certain drugs. Grof designates such 'complexes' as 'COEX-experiences' (from *co*ndensed experiences). The phenomenon of state-dependent learning and memory (see below) belongs in the same context. Advertising has made wide use of the discovery that storage and mobilisation of cognitive stimuli strongly depend on emotional factors. Selective cognition, in particular during emotional states such as anger, fear, rage, and love, is an everyday observation, described also by Bleuler (1926) under the notion of a "switching function of the affects". Furthermore, we have been able to show (Ciompi, 1988*b*) that affects play a role which goes far beyond mere accompaniment of seemingly purely cognitive processes such as abstraction. In the 'extraction of invariance', which is the core of solving of scientific and mathematical problems by abstraction, common feelings of pleasure or displeasure connect elements that 'fit' or 'don't fit'. Therefore these affects function literally as pointers to solutions. Functional cognitive concepts and theories are invested with positive feelings and dysfunctional ones with negative feelings. Adequately coherent behaviour over time (e.g. the realisation of a project, the building up of a human relationship) is also only possible with a sufficiently stable positive 'affective investment' (cf. Freud, 1926). (In a related context, Janzarik (1988) speaks of the central phenomena of 'actualisation' and 'de-actualisation' of cognitive elements.) If, on the other hand, emotional continuity is lacking, as in psychotic ambivalence, behaviour soon becomes incoherent. Specific prevailing affects resemble specific 'gates' opened by specific triggers (Bandler & Grinder, 1975), leading to specific affective cognitive programmes for dealing with a certain person, a certain problem, a certain piece of work, etc.

The mobilising, organising, and integrating functions of the affects are no less important in the *social domain* than in the individual domain. Affects, as defined above (i.e. collective emotional moods, attitudes, motivations, and value connotations), are not only what move social systems, but what hold them together both synchronically and 'over time', regardless of their size. A society lacking a cohesive emotional basis will inevitably fall apart: concerted, purposeful social action is possible only if based on some shared affect (whether it be fear, anger, joy, or enthusiasm). Such affects are also known to be highly contagious; even subtle affective nuances are rapidly transmitted to individuals, groups, and peoples. The most conspicuous example of this is mass panic or collective hysteria. A related phenomenon is that of social control – a mechanism that serves to maintain social cohesion by eliminating divergent thought, feeling, and behaviour. Generally speaking, positive affects (and in particular love), have binding functions, and negative affects (aggression) have separating and delimiting functions. Finally, the affects also function in the social domain as memory-forming and memory-mobilising 'switches'; they 'attune' and determine, and therefore regulate all social behaviour, simultaneously forming the basis of all social communication.

In summary, in addition to providing motivation and direction for the individual, affects have organising and integrating functions in the whole psychosocial field. They connect synchronically and diachronically what functionally belongs together, thus providing mental programmes with the necessary coherence in the present as well as continuity over time. Simultaneously, they constantly 'affect' and involve the whole body, in the sense that they attune it to the demands of a given situation, utilising all past experience. Moreover, they probably make a decisive contribution to the state-dependent and context-appropriate fixation and mobilisation of memory. In other words, the affects not only function as 'motors' on cognitive elements, as Piaget (1981) presumes, but also as 'switches' or 'gates' and as 'glue' or 'connective tissue'.

Biological aspects

Is such a model also supported by biological findings? In fact, this model corresponds to the basic structural and functional design of the brain. According to MacLean (1964, 1973), three large segments of the human brain can be distinguished phylogenetically.

(a) The 'reptilian brain', including the striatal complex (basal ganglia, corpus striatum, globus pallidus) and portions of the brain-stem and cerebellum. Apart from such basic vital functions as regulation of respiration, blood pressure, body temperature, sleep–waking rhythm, arousal, and orientation, it primarily regulates pre-programmed behaviour (instinctive acts).

(b) The 'lower mammalian brain', characterised by a developed limbic system (gyrus cinguli, hippocampus, amygdala, septum, habenula and hypothalamus). This is a cortical and subcortical 'border zone' representing a highly differentiated hormonal/biochemical regulatory apparatus for the flexible modulation and context-appropriate attunement of the organism as a whole, in accordance with its changing needs. It also functions as a central switching and regulatory area of 'affects' (as defined above).

(c) The 'higher mammalian brain', is distinguished by a highly developed neocortex, most pronounced in human beings, and associated with all higher cognitive functions. This development, in particular, "opens up completely new ways of suppressing routine forms of behaviour, whether inherited or acquired, on the basis of a subtle, dispassionate analysis" (Ploog, 1986).

MacLean's distinctions support the hypothesis of a central role played by affective regulations as a mediator between basic vital functions and higher cognitive processes: on the one hand, they influence and modulate automatic instinctive behaviour, and on the other, they form the foundation of higher intellectual achievements. At the same time, they regulate the 'mood' of the entire peripheral body, through the hormonal apparatus.

This interpretation becomes even more plausible when the functions of the limbic system and its connections to other regions in the brain are considered. In recent years, the importance of the limbic system both in the regulation of mood and in emotional and instinctive behaviour – first postulated by Papez (1937) and by Klüver & Bucy (1937, 1939), and later by MacLean (1952, 1958) and Nauta (1958, 1973) – has become increasingly evident (Koella, 1984; Nieuwenhuys, 1985; MacLean, 1986; Doane & Livingston, 1986). Not only in the hippocampus and the amygdala, but also in many other areas of the limbic system (e.g. the gyrus cinguli, the region of the septum, the nucleus caudatus, and the frontal bundle), cell groups have been discovered whose stimulation leads to pleasant or unpleasant feelings (anger, fear, joy, pain, sexual arousal, etc.). Globally, the structures providing pleasurable feelings seem to function as an integrated 'award system'. Moreover, the removal or destruction of certain limbic structures brings about profound emotional changes; a familiar example of this is the Klüver–Bucy syndrome (hypersexuality, loss of fear and aggressiveness, excessive oral exploration), which is caused by lesions in areas of the uncus, amygdala, and hippocampus. According to MacLean (1986), the feelings and drives activated by the amygdala mainly subserve self-preservation (the search for food, feeding, fighting, and self-protection); those activated in the region of the septum subserve the preservation of the species (procreation), and those activated by the cingulum are related to maternal–offspring contact (i.e. maternal care, fear of separation, isolation call) and (very important to human development) play.

Furthermore, contrary to Papez's (1937) original idea of the limbic system as a self-contained 'reverberating' circuit, it has been shown by more recent investigations to function in close co-operation with many other regions of the brain, particularly the pre-frontal cortex, hypothalamus, mid-brain, brain-stem, and even the spinal cord (Koella, 1984; Nieuwenhuys, 1985; Poletti, 1986). Nieuwenhuys ascribes to the neuromediator-rich nuclear region – the 'limbic axis' (Nauta, 1973) – the central regulation of neuroendocrine and visceral effector mechanisms, on the one hand, and of affective and motivational behaviour, on the other. Poletti (1986) sees the limbic system as an amplification and refinement of the hypothalamus, and assumes that it can potentially modulate all the functions of the brain-stem, including the fight-or-flight mechanism, pain suppression, sexual development, and autonomic and endocrine activities. According to Mishkin & Appenzeller (1987) the amygdala endows sensory stimuli with specific emotional qualities – gives them a qualitative colouring. The recently discovered non-synaptic 'paracrine' transmission of stimuli across extracellular spaces, and possibly even across the ventricle, could also be connected with a global attunement of larger regions of the brain (Nieuwenhuys, 1985).

Another fact supporting the regulatory and integrative effects of the physiological substrates of affects on various neuronal systems, as is also assumed by Wexler (1986), is that practically all the important neurotransmitter systems are involved in the neuronal connections projecting from the limbic system (especially the noradrenergic, serotonergic, dopaminergic, GABA-ergic, glutaminergic and the polypeptidergic systems). This is important in the present context, since most neurotransmitters also influence or mediate affect. With the limbic system serving as a junction, these neurotransmitter systems connect, longitudinally and in stages, some of the most diverse, widely separated regions of the brain. They would therefore be perfectly able to integrate extended neuronal systems into extended operational entities, according to the subject's emotional state.

Another piece of evidence for the key regulatory role of the affects can be found in the relationship between the limbic system and memory, and in the role of neuroplasticity in memory formation. The fact that memory and learning capacity are dependent on the integrity of certain limbic structures, particularly of the hippocampus and amygdala (Mishkin & Appenzeller, 1987; Barnes, 1988; Squire & Jola Morgan, 1988) initially led to the belief that the very 'centre of memory' is located in these areas. Meanwhile, it became increasingly clear that the 'store of memory' cannot be located in a circumscribed region of the brain, but is much more probably scattered over wide areas of it. The cerebellum, for example, is known to be involved in motor memory performance (Lisberger, 1988).

This would be a necessary consequence of the 'plasticity' of all areas of the brain ('plasticity' implying that neuronal transmission is permanently facilitated and thus fixed by repetitive stimulation) (Groves & Schlesinger, 1979; Changeux & Konishi, 1987; Greenough & Bailey, 1988; Morris *et al*, 1988). This is brought about in part through electrophysiological changes in (habituation and sensitisation of) the synapses, and in part through the branching out of new dendritic connections between individual nerve cells to meet functional demands. At least some of the electrophysiological processes that endow single nerve cells, and even single molecules with 'memory' have recently been discovered (Crow, 1988; Gustavson & Wagström, 1988). Through neuroplasticity, repetitive environmental stimuli become fixed in the brain, so that in a general sense, the real 'memory' is the structure of the neuronal network itself, as it is acquired by action. Moreover, if we relate the various findings on memory to each other and include the clinically obvious relationship between memory and affects, the hypothesis is emerging that an 'affective imprint', mediated through the limbic system and its neurotransmitters, is needed both for the fixation and for the activation of the extended neuronal pathways representing memory storage. At the least, this single assumption would be capable of plausibly connecting, on the psychological, social, and biological level, many phenomena that initially seem heterogeneous, including the 'switching power of affects'.

The hypothesis of integrative functions of affects is further supported by a series of computerised electroencephalographic studies concerning state-dependent learning and memory (cf. Koukkou & Lehmann, 1980, 1983; Koukkou *et al*, 1983, 1986; Koukkou, 1987). These show that learning and memory performance can vary greatly, depending on the motivational/functional state of the brain (sleeping or waking, dreaming, childhood or adulthood, drug-induced, hypnotic, or psychotic states). Simultaneously, there are more general differences in information processing (e.g. concerning the form, strength, and duration of the orientating reaction). Information which has been stored in a certain functional state is best remembered in the same state; however, information stored in highly differentiated states (e.g. in the normal waking state) remains available in less differentiated states (e.g. in dream or hypnotic state), but not vice versa (Overton, 1979). Therefore, Koukkou *et al* propose that specific memory stores and specific modes of information processing are activated or blocked by specific motivational states (of the brain).

In analogy, we propose that differential emotional states, such as anger, fear, joy, love, etc., also correspond to different functional states of the brain. This hypothesis is also supported by the recent successful differentiation of five 'basic emotions' (intention, fear, mourning, joy, aggression) by electroencephalographic spectral analysis, validated by reliable clinical differentiation of the same affects (Machleidt *et al*, 1989). When linked to the findings on state-dependent information processing, this work seems to provide an interesting methodological basis not only for a further clarification of the hypothesis of register-like switching effects of emotions on certain cognitive contents, but also of other relationships between emotion and cognition which are postulated by the concept of 'affect logic' (see below).

Finally, certain comparative ethological studies carried out on reptiles or on lower and higher mammals, reported on by Ploog (1986), are of interest. Through the use of vocal markers of mood, which are reliably attributable to specific emotional states, electrical stimulation experiments on the limbic system of the squirrel monkey have been successful in localising different patterns of arousal, correlated with different types of emotion. According to Ploog (1986), these patterns are innate and can be determined in basically the same way in diverse species, from the highest primates all the way down to the reptiles. Therefore, it may be concluded that the lower animals do in fact possess something like 'emotions', although only humans are capable to some degree of voluntary control over their emotions. A striking example of the organising function of such integral 'emotions' in the lower animals can be seen, for instance, in reptiles; the shiny white marking on the head of the male Mexican iguana, signifying his dominant position among his fellows, instantly changes to a dirty brown colour when he loses this position to a rival. At the same time, his social behaviour also changes entirely.

Discussion

At the biological level, therefore, there are also a number of facts supporting the hypothesised mobilising, organising, and integrating functions of 'affects' or 'emotions'. Convergent findings from all three domains may thus be combined at least tentatively in the following new psychosocial/biological model of the psyche.

The 'psyche' can be understood as a complex hierarchical structure of operationally-integrated affective cognitive schemata or systems of reference, which are continuously generated by action itself as a 'condensation' of the whole experience. They function as comprehensive operational programmes for feeling, thinking, and behaving. Simultaneously, they provide the functional basis of all perception and communication. Their biological substratum is a corresponding network of privileged neuronal pathways, generated through repetitive action, which stores in its structure past events as a 'memory'. The limbic and hypothalamic systems play a key role in the regulation and integration of affects with cognitive sensorimotor functions. Both on the psychosocial and on the neuronal level, the affects or 'emotions' (their respective neurophysiological equivalents) function as central organisers and integrators, insofar as they:

(a) provide all incoming cognitive sensorimotor stimuli with a specific qualitative connotation and motivational direction
(b) participate in the state-dependent storage and contextural mobilisation of cognitive material
(c) connect functionally related cognitive elements synchronically and diachronically
(d) participate through this 'extraction of invariance' (common emotional connotations of different cognitive elements) in the generation of new affective cognitive systems of reference, on a higher level of abstraction
(e) through their hormonally mediated peripheral effects, simultaneously attune the whole organism to the demands of the current situation, on the basis of all past experience.

Important additional insights are provided into the central question of the relationships between the mental, social and biological domains by the concept of structural coupling of separate self-organising systems, elaborated by Varela (1979) and Maturana (1982). These authors see the neuronal system, 'external' social behaviour, and mental conceptualisation by a (human) observer as three different, self-contained functionally 'closed' phenomenological domains; each one tends to maintain its own structure and organisation. However, they influence one another in a domain of interaction (but only there), and thus give way to some degree of reciprocal modification and coupling. It is proposed here that Maturana's and Varela's self-contained domain of conceptualisation by an observer should be extended to the whole 'mental' or 'intrapsychic domain', thus arriving at the concept of (at least) three self-organising and functionally 'closed' phenomenal domains or systems. These are related to each other by reciprocal coupling – of the intrapsychic/mental domain, the interpersonal/social domain, and the neuronal domain.

A simple example of a structural coupling of two different physical systems can be found in the wave structures mutually produced in the area of interaction between wind and water. Analogous but much more complicated instances of structural coupling must be assumed between the psychic, social, and biological domains. An example is the biologically determined experiences of pleasure or displeasure which may induce corresponding mental representations and motivations which, via specific social (e.g. sexual) behaviour, may in turn lead to psychological, social, and biological modifications, e.g. in the form of additional hormonal changes, or the establishment of new pathways of neuronal associations. It is important to note that the concept of structural coupling implies that no phenomenological domain can ever be totally reduced to another, even though they may influence one another. Thus, the specific 'psychic domain' is most certainly capable of being modified by the biological, but it can never be completely 'explained' or even 'understood' by it – and vice versa. A hierarchy exists, however, insofar as there is a priority of the biological (and social) domain in respect of evolution, but a supremacy of the psychological (and social) domain in respect of complexity (cf. Sabelli & Carlson-Sabelli, 1989). It therefore seems reasonable, on the one hand to investigate each domain separately, but on the other hand, to give special attention to elements which connect them – the 'mediators'. One typical mediator is neural plasticity. But the notion of stress, with its relationship to the neurotransmitters and immune system, and on the theoretical level, all the general concepts from cybernetics and systems theory also represent different kinds of 'mediators' which are capable of bridging the psychosocial/biological hiatus (Ciompi, 1989).

In this context, it should be emphasised again that, as a consequence of the hypothesis of affective cognitive systems of reference as basic 'building elements' of the psyche on different hierarchical levels, findings from general systems theory can also be applied, in principle, to the psychosocial domain. This becomes particularly relevant in connection with the remarkable analogies that seem to exist between the effects of energy in physical or biological systems on the one hand, and of information in mental systems on the other (Ciompi, 1988*b*): just as material systems can be understood as organised energy, affective cognitive systems of reference can be understood as organised information. Disturbing new information will first be rejected, and, when this is no longer possible, finally be integrated, in three stages , α, β, μ, to an overall structural modification of the particular mental schema (Piaget, 1976). Emotional factors will obviously play an important role in these processes, for instance in the destabilising effects of positive feedback loops which amplify deviations. Therefore, the generation of new forms of mental organisation through the input of disturbing additional information represents a direct analogy to the sudden emergence of the 'dissipative structures' (complex patterns of energy dissipation) which, according to chaos theory, can arise from continuous energy input in all kinds of physical or biological systems (cf. Prigogine & Stengers, 1981; Nicolis & Prigogine, 1987; Ciompi, 1988*b*, 1989).

An empirical refutation of the proposed model – which is a crucial question – can only be expected partially and step by step. Both cognitions and emotions can, however, be measured already with considerable accuracy in the psychosocial and, recently, in the biological domains. By combining current psychological and sociological methods with modern electroencephalographic, biochemical and brain imaging techniques, the following hypotheses should be accessible for refutation:

(a) affective processes are always accompanied by cognitive processes, and vice versa
(b) different affective states correspond to different functional states of the brain, characterised by different modes of information processing
(c) specific affects tend to be related to specific cognitive contents, and vice versa, forming functional affective/cognitive systems
(d) affects and their respective neurophysiological equivalents are involved in the storage of cognitive information
(e) affects and their respective neurophysiological equivalents are involved in the mobilisation of stored cognitive information
(f) in specific affective states, specific cognitive contents tend to be mobilised
(g) affects and their respective neurophysiological equivalents are capable of integrating extended neuronal systems into operational entities which regulate context-specific feelings, thoughts, and behaviour.

Eventually, an empirical verification of the postulated involvement of affects in the process of abstraction should also become possible, as well as a verification of the proposed analogies between information and energy, and of the assumed reciprocal structural coupling between the mental, social, and biological domains. Moreover, the possibility is not excluded that all the organising and integrating effects of emotions could be related, in the last analysis, to a single fundamental mechanism, such as the involvement of the neurophysiological equivalents of affects in neuroplasticity (i.e. by contributing to the generation and eventually, to the reactivation of affect-specific neuronal pathways).

A final question, which has been dealt with at greater length elsewhere (Ciompi, 1988*b*, 1991) concerns the possible practical, and in particular psychiatric, application of the proposed model, especially for a better understanding and treatment of the psychoses. According to the hypothesis, affective factors probably play an important role not only in the 'affective' psychoses, but also in schizophrenia. Both acute and chronic schizophrenic symptoms (e.g. disturbances of thinking and attention, affective cognitive ambivalence, emotional flattening, social withdrawal, reduction of interests, etc.) are better understood by considering the assumed close functional links between emotion and cognition. So far as the optimal therapeutic milieu for schizophrenics is concerned, emotional factors seem to be strongly under-valued. Last but not least, potentially important new findings could emerge from the proposed application of the model to the exploration of the evolutionary dynamics of the psychoses as suggested by modern chaos theory (Ciompi, 1989).

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