

Remembering a depressive primary object:

Memory in the dialogue between Psychoanalysis and Cognitive Science

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Memory has always been a central issue in psychoanalytic theory and practice. Recent developments in the cognitive and neural sciences suggest that traditional notions of memory based on stored structures which are also often underlying psychoanalytic thinking can not account for a number of fundamental phenomena and thus need to be revised. We suggest that memory be conceived as a) a theoretical construct explaining current behavior by reference to events that have happened in the past. b) Memory is not to be conceived as stored structures but as a function of the whole organism, as a complex, dynamic, recategorizing and interactive process, which is always 'embodied'. c) Memory always has a subjective and an objective side. The subjective side is given by the individuals history, the objective side by the neural patterns generated by the sensory motor interactions with the environment. This implies that both 'narrative' (subjective) and 'historical' (objective) truth have to be taken into account achieving stable psychic change as is illustrated by extensive clinical materials taken from a psychoanalysis with a psychogenic sterile Borderline patient.

Introduction

Remembering still is a central issue in clinical psychoanalysis. Most contemporary psychoanalysts probably share the common ground that inadequate, psychopathological thoughts, emotions and behaviours of patients are determined by unconscious fantasies and conflicts which had been adaptive in an unknown past situation. In other words they think that their patients are guided by their implicit memories or former pathogenic or traumatic object relations and experiences, which are—unconsciously—repeated in their current feelings and symptoms. Sandler and Sandler (1997) speak of dynamic templates of early experiences. But how do these 'templates' function? How does memory work? Can patients remember 'historical truth' or are memories mainly 'constructed' narratives

containing the truth about history which the patient just can stand emotionally at the moment and which, perhaps, don't have much to do with biographical facts (see Cooper, 1989; Fonagy, 1999; Ganaway, 1989; Howard, 1991; Köhler, 1988; (KOHLET 1998 IN REFS—PLEASE CONFIRM WHICH IS CORRECT)Leuzinger-Bohleber and Pfeifer, 1998; Modell, 1990; Spence, 1982; also summarised in Thomä and Kächele, 1985)? Is it justified that Fonagy and Target (1997) conclude '... whether there is historical truth and historical reality is not our business as psychoanalysts and psychotherapists'(p. 216). Why then is remembering of a specific biographical situation often connected with therapeutic progress especially with severely traumatised patients, as analysts in many clinical papers claim (see Bohleber, 2000; Kogan, 1998; Krystal, 1988; Laub, 2000; Varvin, 2000)? And, in case this proves to be true, in what specific transference situations do new memories occur? And why?

All these questions are discussed intensively within the psychoanalytic community nowadays, e.g. in the relevant, but emotionally charged debate on recovered and false memory (see Brenneis, 1994; Brooks-Brenneis, 1997 1997 IS CORRECT BUT NO 1994 IN REFS—PLEASE CONFIRM WHICH IS CORRECT OR ADD NEW DETAILS) 1996; Loftus, 1993; Motron, 1997; Sandler and Fonagy, 1997; Shevrin, 2001; Sinason, 1997(SIANSON IN REFS—IS CORRECT PLEASE CONFIRM WHICH IS CORRECT); Sugarman, 1994). Although we don't intend to go into this debate within the framework of this paper, we think that some of the following interdisciplinary considerations on memory could also be of interest for the critical discussion on 'false' or 'true' childhood memories. Our special focus in this paper deals with the question of if and how interdisciplinary memory research can add to our understanding how remembering occurs and functions within the psychoanalytic situation.

Interdisciplinary memory research has boomed in recent decades, in particular since new methods in the Neurosciences (MEG, EKP, PET, fNMR) opened fascinating possibilities to study psychic processes in the living brain (see papers published in the new journal *Neuro-Psychoanalysis*). A large number of studies using neuro-imaging are going on at the moment and seem to discover a large variety of different memory systems in the brain (see Schacter, 1989; Tulving, 1985; Pfeifer and Scheier, 1999; Meares, 2000). Such a booming experimental field and the publication of a great amount of different findings and their interpretation often create well-known difficulties, e.g. that it becomes more and more impossible to get an overview on the 'state of art' in memory research as the following chart illustrates:

Insert figure 1 about here

Thus one aim of our paper is the attempt to offer some integrational suggestions

based on the current discourse on memory in Cognitive Science. Of course, we can only give a short impression of the direction and some of the results of this theoretical debate within the framework of this paper. Cognitive Science was originally defined as an interdisciplinary approach to the study of the mind, including artificial intelligence, psychology, neurosciences, linguistics, philosophy and more recently also biology and engineering. Given the novel focus on embodiment it could be viewed as the scientific discipline trying to unravel the mechanisms underlying intelligent behaviour. This includes, but is not restricted to, the study of the mind. Cognitive Science is specialised in integrating knowledge from different disciplines in theoretical models and in discussing critically the fundamental problems connected with such an attempt. We think that psychoanalysis has much in common with this discipline: it also deals with (unconscious) mechanisms underlying adaptive or maladaptive functionings of the mind and tries to integrate complex (clinical-empirical) findings in theoretical models. Just to mention one of many impressive examples: for years Josef and Annemarie Sandler (1997) tried to integrate new insights of memory research in their conceptualisations of a 'present' and 'past unconscious' thus modifying and differentiating one of the central issues in psychoanalysis: unconscious functioning. For us the analogy in research questions the aims of psychoanalysis and Cognitive Science is one reason why this interdisciplinary dialogue promises to be fruitful (see also Bucci, 1997; Colby and Stoller, 1988; Moser and von Zeppelin, 1996).

A challenging side of the concrete interdisciplinary dialogue is that each partner has to dim (HAS TO STEP IN- IS THIS BETTER? PLEASE CLARIFY MEANING— PHRASE AS 'CONCEDE ground') in the fascinating, but often strange and irritating world of the other scientific discipline. It is well known that each science has developed its own knowledge base, terminology and research methodology, and also its specific ways and styles of argumentation and communication. This is the case for psychoanalysis as well as for Cognitive Science. We hope that our psychoanalytic readers will enjoy and tolerate the journey to an unknown scientific world and finally share our own experience that the 'triangular' perspective from a foreign discipline on one's own practice and theories is an innovative and worthwhile enterprise.

In the hope of softening some troubles of such an interdisciplinary journey we have chosen to discuss some of the insights on memory in 'Embodied Cognitive Science' not exclusively theoretically but in the context of a clinical case study, a sequence of a psychoanalysis with a borderline patient who belonged to a group of psychogenic sterile women with whom I (M.L-B) have worked in recent years (see Leuzinger-Bohleber, in press). We will use this clinical material to illustrate a number of theoretical points. Our main arguments are: first, memory is a theoretical construct explaining current behaviour by reference to events that have happened in the past. This implies a clear separation between describing behaviour in terms of memory (e.g. remembering in the

transference) and underlying brain mechanisms subtending this behaviour (frame-of-reference problem); second, memory is not to be conceived as stored structures (computer metaphor, or in psychoanalysis ‘stored’ representations etc.) but as a function of the whole organism, as a complex, dynamic, recategorising and interactive process, which is always ‘embodied’, in other words based on actual sensory-motor experiences and manifests itself in the behaviour of the organism; third, memory is not an abstract cognitive function but embodied and as such a property of the entire organism. It is important to realise that embodiment does not simply mean ‘non-verbal’: it implies that there is a coupling between the sensory and the motor processes, which has significant implications for neural information processing; and fourth, memory always has a subjective and an objective side. The subjective side is given by the individual’s history (developmental perspective), the objective side by the neural patterns generated by the sensory motor interactions with the environment. This implies that both ‘narrative’ (subjective) and ‘historical’ (objective) truth have to be taken into account achieving stable psychic change.

We start our paper with a short presentation of the clinical background. Then we focus on ‘remembering in the transference’ and discuss classical and recent, biologically oriented, embodied models of memory processes. Next we will illustrate what these models may add to a genuine psychoanalytic understanding. We hope to show that clinical psychoanalytical theorising of early memory can be integrated with empirical and conceptual findings. In a final section we will summarise what, in our view, we can learn from this endeavour.

Hypotheses concerning the biographical roots of psychogenic sterility in a certain group of women: dealing with memory in a psychoanalysis

In a recent clinical paper I summarised my psychoanalytical experiences with ten psychogenic sterile women. In the psychoanalyses with these women we finally discovered a common unconscious fantasy, which I characterised as the ‘Medea-fantasy’ (Leuzinger-Bohleber, in press). This fantasy contained the unconscious ‘truth’ that female sexuality is connected with the danger of becoming existentially dependent on the love object who could exploit and hurt you narcissistically and finally leave you, an experience which would lead to uncontrollable affects and mobilise destructive impulses that would lead either to the destruction of the self, the love object or even the products of the love relation with him—their own children. Therefore—unconsciously—it seemed to be ‘safer’ for these women to experience their female body as ‘dead’, frigid and sterile and to avoid motherhood. Another striking commonality in these treatments was that all of these women had gone through similar traumatisations during their first year of life. Their mothers had suffered from severe depressions and had been treated

with antidepressive drugs during the first weeks or months of my patients' lives. How did we discover this 'historical truth' in the biographies of these women? And why did the reconstruction of these biographical specificities prove to be important for therapeutic progress?

In order to illustrate these findings we present just a short sequence from a psychoanalysis with a 28-year-old patient who looked for psychoanalytic help because she suffered from a severe phobia, compulsion to wash her hands (until they were bloody), biting her nails, sleeping and eating disturbances, and a nearly total social isolation. Unconsciously she also suffered from severe conflicts with her feminine identity. When 18 years old she had suffered from an anorexia nervosa and had been hospitalised in different psychiatric institutions.

During the first two years of treatment severe autonomy conflicts mostly dominated our psychoanalytical sessions: Ms M started the sessions right away with talking and talked and talked and talked practically without any interruption during the whole session. She literally ignored me and seemed to have a strong need to control me. Nevertheless psychoanalysis appeared to have some effect on her: after she had been unemployed for two years, spending her days lying in bed in a dark room, she looked for a job and started to get into contact with people again in the sixth month of treatment. In spite of these obviously positive developments my countertransference reactions became more and more intensive: I felt insufficient, devaluated and helpless. I was hardly able to stand the extreme tension during the sessions, resulting in my suffering bad feelings and psychosomatic reactions, especially stomach colics, which frequently occurred during the sessions at that time. In the second year of analysis these countertransference feelings became so dominant that I finally became convinced that the indication for psychoanalysis had been wrong. I observed a strong impulse to free myself from this woman in some way. At the same time I felt threatened by the fantasy that my analysand would commit suicide if I sent her away. I finally consulted my supervision group. After a long and difficult discussion one of my colleagues had a key-association: 'I have the feeling that your patient does everything necessary in order to evoke in you the impulse to abort her'. I had the strong impression that this association was somehow able to uncover an unconscious truth. These feelings and fantasies helped me to regain a certain intermediate space within me (see Winnicott, 1971) and evoked again curiosity and interest for the hidden psychodynamics of my patient. As a consequence I was able to stand the emotional tension during the next session much better. In the following session Ms M reported the second dream of her analysis: '*I am lying here on this couch and am very seriously ill. It could be that I am dying. You give me a huge injection. I am terribly scared, but I know that it is my only chance to survive ...*' She associates that she realises that this is her first dream in which she is not alone but together with another person and that I, as such a person, have to hurt her in order to

help her. ‘Human relationships seem to be connected somehow with a fight over life and death for you’, I commented. Ms M began to cry. Practically for the first time in this psychoanalysis there was a pause. After this pause Ms M said: ‘Strange, a new memory just came to my mind, a scene that I must have forgotten and which probably happened during my Kindergarten time: My father furiously screamed at me and shouted: ”If only your brother had survived instead of you!”’ I asked if I had understood her correctly. After all, her brother, who was two years younger, was still alive! My patient wondered, too, and started to investigate the issue and interviewed her mother who told her, for the first time in her life, that she was a twin and that her twin brother had died during a very dramatic birth. During the same phone call, her mother also told her that she had wanted to have an abortion. She had fallen into a serious postpartum depression after the loss of her baby son and had had to be treated with antidepressives for eight months.

This biographical information turned out to be of central importance for our psychoanalytic work: the unconscious fantasy of this woman of being a murderous and unloved person (a ‘Medea’) became more plausible and understandable. But did the above-mentioned scene really happen the way Ms M remembered it? Was it an (oedipal) fantasy of hers? Was it a screen memory of the object relation with the depressive primary object in the first months of life? Do we have to understand these memories as a narrative or as a historical truth? And why were these memories evoked just at this point of the psychoanalysis?

Remembering in the transference

As already mentioned, in a general context such questions have been discussed controversially and in great detail in the psychoanalytic community during recent years, an interesting discourse that we can only mention here. The following section describes some of our own efforts to contribute to this discussion.

Models of memory in ‘Classical Cognitive Science’

Fifteen years ago we discussed these questions in a paper in the *International Review of Psycho-Analysis* analysing three key scenes of a psychoanalysis (Pfeifer and Leuzinger-Bohleber, 1986). In these analyses we tried to start an interdisciplinary dialogue between ‘Classical Cognitive Science’ and psychoanalysis on the questions of memory processes. In 1983 we began to refer to the recent approaches to memory—which were much discussed at the time and were expounded by Schank (1982) in his book *Dynamic Memory*—to explain memory processes during psychoanalysis and seemed to shed new light on core psychoanalytic concepts, such as repetition compulsion, the rule of abstinence and the working through of central conflicts in

transference. Among other things we showed that the focus concept of psychoanalysis can be described very precisely by a memory structure that resembled Schank's (1982) TOP, the 'Thematic Organization Point'.

Insert Figure 2: Triangle of insight

We showed that the psychoanalytical concept of a focus as illustrated by the 'Triangle of insight' (see Figure 2) connecting analogous structures of an *actual conflict* with those discovered in the *transference* and *biographical information* corresponds in detail to Schank's TOP. We illustrated this hypothesis analysing some information from a psychoanalysis with a severely depressed woman. We found analogous components in the *actual conflict situation* (feeling exploited by her husband), the *transference* (being convinced that her analyst would 'only' be interested in pursuing her own goals, e.g. earning money) and a *traumatic experience of infancy* (being exploited by her mother as a 'protection' against Russian soldiers during a frightening nightly escape during World War II). We discussed that in all these three 'key scenes' we found the components of the TOP, a finding that seemed to deepen our clinical and theoretical understanding of the psychodynamics of the analysand and her memories evoked in psychoanalysis.

We now could apply this memory concept in an analogous matter to the above-mentioned case material: in the *actual conflict* (e.g. Ms M, who was a university student at that time, felt 'aborted' from the *alma mater*, the university, because she was 'judged' not 'good enough' to survive in this institution). In the *transference* we observe a similar 'truth' in the countertransference fantasy of the analyst, to 'abort' analysis risking the suicide of Ms M. Questioning her mother, Ms M gets the *biographical information* that her mother wanted to abort her, intending to get rid of the pregnancy (and the unborn Ms M). In all three topics we could find the same (cognitive) components of the TOP.

According to Schank, a TOP includes the following components: a goal configuration, expectations of plans and outcomes, actual plans and outcomes, and explanations of discrepancies. TOPs are abstract memory structures that are stored and are usually unconsciously recalled by so-called 'demons'. Demons are programmes that are continuously on the alert for an event to take place; in this case the event is the occurrence of a situation that is structurally similar to an earlier one. Although Schank talks about 'dynamic memory', this concept presupposes a 'static' notion of memory. The dynamic aspect of memory in Schank's concept is the establishment of new references to other memory structures. For example, if there is a new failed expectation, a reference is established from the failure point to a representation of the situation from which the (failed) expectation had been generated. However, this notion still implies a kind of storehouse in which memory structures—knowledge—are kept, analogous to

records stored on a disk in a computer. The classical cartoon by Lindsay and Norman (1981) illustrates this notion of memory (Figure 3): memory is divided into long-term and short-term memory. Long-term memory is understood by analogy to Aristotle's famous notion of memory as a wax tablet on which experiences are written. In case the demons recognise a certain pattern as being similar to a memory structure stored in long-term memory, this structure will—if the censor does not intervene—be transferred to short-term memory where it then is accessible to conscious remembering.

*** Insert Figure 3 about here***

Schank, as well as Lindsay and Norman, formulate a 'classical' definition of memory that is still very popular, and a significant number of psychologists, psychoanalysts, memory researchers and nonscientists also maintain this view. If one asked a layperson what memory is, more than likely his answer would be something like 'a place in the brain where information is stored'. In everyday language, we often describe mental processes as objects in an actual physical space. For example, we speak about storing something in memory, or searching through memory, or of holding ideas in our minds; like physical objects, memories may be lost or hard to find, and so forth. About 75 per cent of the analogies used as models of memory assume storage and search (Roediger, 1980). Memory as a stored structure is also found in many textbooks today (see Ashcraft, 1994). Baddeley uses the following definition: 'Human memory is a system for storing and retrieving information, information that is, of course, acquired through our senses' (1997, p. 13). In essence memory is viewed as information that is stored and later retrieved.

Models of memory in 'Embodied Cognitive Science': memory as a 'dynamic and constructive process of the whole organism'

The classical conceptualisation of memory, however, leads to many theoretical problems, as has been discussed in extenso in the Cognitive Science literature (see Bursen, 1980; Clancey, 1993, 1997; Edelman, 1987, 1989, 1992; Rosenfield, 1992; Pfeifer and Scheier, 1999), and in the psychoanalytic literature (see Hirshberg, 1989; Sandler and Sandler, 1997; Fonagy and Target, 1997; Leuschner, Hau and Fischmann, 1998; Kurthen, 1998; Leuzinger-Bohleber and Pfeifer, 1998; Shevrin, 2001). It cannot, for example, be used to give a plausible explanation of how knowledge can be applied repeatedly to new situations, i.e. how learning processes occur that require a new situational analysis, how problem solutions can be transferred from one domain to

another, and how new categories are established. Just one example: it is no problem for us to recognise the violin concerto by Beethoven even if a neighbour is practising parts of it playing the piano instead of the violin. This process of remembering cannot be based on simple pattern matching because the current pattern (piano music) is different from the earlier one (violin music). It would therefore not be helpful to just store a pattern somewhere in the brain. Recognition is rather a constructive inner process relating a past experience (listening to the violin concerto) to the actual situation (hearing the piano playing Beethoven).

Therefore—and this is in agreement with many current Cognitive Scientists—it is necessary to conceptualise memory in a fundamentally different way; in other words a change of paradigm seems indispensable (see Clancey, 1997; Glenberg, 1997; Edelman, 1987, 1989; Rosenfield, 1989 1992 IS CORRECT(ONLY 1992 IN REFS—PLEASE CONFIRM WHICH IS CORRECT OR ADD NEW DETAILS); and Pfeifer and Scheier, 1999), a topic that we will discuss now. Most of these alternative conceptualisations capitalise on the notion of embodiment which means—as we will discuss below—that memory can only be understood in the interaction of an organism with its environment. It turns out that if memory is conceptualised according to this new paradigm some of the fundamental problems in understanding memory can be resolved.

Before discussing some characteristics of this paradigm of Embodied Cognitive Science, first we will present a summary of the research methodology of Embodied Cognitive Science, which might contribute to the understanding of the following considerations on memory (see Focus Box).

Focus Box: Embodied Cognitive Science—Research Methodology

A change of paradigms is always connected with a change of research methodology. One fundamental criticism of the storehouse metaphor came from biologically oriented memory researchers. >From a perspective of adaptive behaviour, they argued that living systems could not survive in a constantly changing environment if memory would function like a computer. Living organisms are forced to adapt constantly to new situations transferring knowledge gained in past situations to new ones which are never identical. Therefore constructive, adaptive processes are indispensable. The organisms can be characterised as self-learning and self-regulating systems in constant interaction with environment. How can these ideas be investigated in the context of memory research?

In contrast to traditional empirical science that uses an analytic methodology, Cognitive Science employs a synthetic approach. It can be characterised as ‘understanding by building’. In other words in order to understand some aspects of a natural system—memory is a case in point—an

artifact is constructed that mimics the natural system. The standard 'artifact' is a computer model which is now used widely in virtually all sciences. In psychoanalytic research computer simulation was used since the nineteen sixties to test the inner consistency and the terminological and logical precision of complex theories. For example, Colby and Gilbert (1964) validated by computer simulation parts of the models explaining neuroses. Colby (1975) studied the determinants of paranoia (see also Colby and Stoller, 1988). Wegmann (1977) developed a computer simulation model of the counter will. Clippinger (1977) simulated the cognitive processes of a patient at the beginning of a psychoanalytic session. The research group of Ulrich Moser in Zurich undertook a whole series of such studies simulating defence and dream mechanisms (see Moser, v.Zeppelin, 1996). (NOT IN REFS—PLEASE ADD DETAILS, PLEASE TAKE MOSER, V.ZEPPELIN, 1996 HERE)

Other researchers have used computer simulation developing different types of memory phenomena (e.g. Baddeley, 1997). One problem with most computer simulations of memory is that there is no direct interaction with the environment: input and output of these models are typically feature vectors predefined by the designer of a model. This contrasts strongly with the real works: humans interacting with their environment are not exposed to 'feature vectors', but to continuously changing sensory stimulation. This is why many Cognitive Scientists have turned to using autonomous robots because they have interaction with the real world without human intervention. In other words if the robot is to display appropriate behaviour it must always include the complete sensory-motor loops. One of the essential advantages of using robots is that the sensory stimulation from different modalities (visual, haptic, auditory, proprioceptive) can easily be recorded and analysed. Moreover, the developmental processes which are typically encoded in an artificial neural network—a model of a biological neural system can be monitored precisely. Thus—in contrast to living systems—changes in the neural network can be observed and traced over extensive periods of time. This is especially important within the context of a developmental framework which is why this research methodology is increasingly used in developmental psychology. In other words the inner changes of an organism in the interaction with the environment can be studied in detail by this procedure. Metaphorically speaking, we can look into the brains of the robots as they are performing their task and therefore learn how experiences influence the (artificial) neural network.

Without going into any details let us just mention that the synthetic methodology has proved enormously fruitful in many areas from ethology, neuroscience to psychology, especially to developmental psychology and—as we will illustrate now—in memory research.

For a long time it was not easy for me (M.L-B) to understand thoroughly the fundamental differences in memory concepts of ‘Classical’ compared with ‘Embodied Cognitive Science’. Therefore we want to discuss three of the central topics quite extensively (a) memory as a theoretical construct, (b) the frame-of-reference problem, and (c) the developmental perspective illustrating them briefly (IS THIS CHANGE OK? YES PLEASE) with psychoanalytic discourses and our case material.

a) Memory as a theoretical construct

As we will illustrate, the ideas developed in this section naturally connect to clinically relevant concepts although the way of argumentation might be unfamiliar or even strange for psychoanalytic readers at first (see Introduction). Cognitive Scientists often use metaphors or short stories to elaborate their considerations. Ashby (ASBY IN REFS—PLEASE CONFIRM WHICH IS CORRECT, ASBY 1956 IS COORECT) wrote this ‘story’ discussing memory as a theoretical construct:

Suppose I am in a friend’s house and, as a car goes past outside, his dog rushes to a corner of the room and cringes. To me the behavior is causeless and inexplicable. Then my friend says: ‘He was run over by a car six months ago’. The behavior is now accounted for by reference to an event of six months ago (1956, p. 117).

In other words, the explanation is not given in terms of the current internal state of the dog, but by reference to an event in the past. Memory, then, is a theoretical construct that connects the state of the individual in the past and the influence the event had on the individual to the behaviour in the current situation. This theoretical notion of memory is to be clearly distinguished from the mechanisms mediating these processes. In this sense, memory is not something sitting somewhere in a box inside the head of the dog, but is a theoretical construct and is attributed to the complete organism. A similar idea is also reflected in the so-called ‘ecological perspective’ on memory where memory is investigated in its function within natural contexts (Neisser, 1988).

This notion of memory is very natural to psychoanalytic thinking. The analyst observes inadequate behaviour in a specific context that he/she does not understand. The goal then is to find analogies to earlier situations (events that have happened in the past) that were perhaps adaptive at the time, and by invoking the concept of memory explain the person’s current behaviour.

In our case story we have described that the analyst did not understand the paradoxical behaviour of Ms M on the couch for a long time (coming to therapy four times a week not being able to listen to anything the analyst said or allowing her to get into a (helpful) relationship with her trying to soften her obvious painful psychophysiological state on the couch). This bizarre form of interaction PLEASE CLARIFY MEANING,)evoked intensive negative countertransference reactions within

her. Thanks to the supervision she finally was able to formulate a first psychodynamic hypothesis ('abortion fantasy') which was modified and differentiated by further observations (dream etc.) and finally supported by the biographical information given by the mother of Ms M. The analysand's behaviour now became more understandable for the analysts: as far as we know from clinical and empirical research interacting with depressive parents means for a small child or a baby an experience of physiological and psychic discomfort, tension and overwhelming negative affects because the depressive parents are not able to empathise in a 'good enough way' with the needs of their child and soften his/her inner state of tension and discomfort (see Stern, 1995). Lying on the couch Ms M (unconsciously) seemed to remember this negative helpless state of an early self. Her behaviour (e.g. her self monologue) reminded the analyst now of a struggle for surviving: the baby of a depressed mother cannot escape and feels physiologically uncomfortable and flooded by negative emotions and pain. It somehow has to try to develop strategies (e.g. a certain hyperactivity; see Stern, 1995) to keep a minimal distance to the depressed object (as Ms M from the analyst).

From a theoretical perspective it is important that the memories of Ms M were not retrieved from a 'box inside of her head' but products of a theoretical construct connecting the observed state of Ms M on the couch with her probable experiences in early childhood.

Again, in order to connect present with past information, nothing needs to be said about the internal neural mechanisms that mediate this transfer. These considerations represent an instance of the notorious frame-of-reference problem, which we will discuss now.

b) The frame-of-reference problem

The frame-of-reference problem states that in explaining memory functions we must make a clear distinction between observable behaviour and the internal brain mechanisms that in the interaction with the real world lead to a particular behaviour. This implies that behaviour cannot be reduced to internal processes, or to brain processes for that matter. Doing so would be committing a category error (to use a philosophical term). This seems trivial but then it is even more surprising that there is a big confusion in the literature about this issue (see Clancey, 1997; Leuzinger-Bohleber and Pfeifer, 1998).

Applied to memory, it implies that a clear distinction must be made between the theoretical construct and underlying mechanisms responsible for mediating between the past and the present. Ashby's concept of memory is neutral to the mechanisms by which it is implemented in the organism. In biological organisms the mechanisms are to be found at the level of neural plasticity, whereas in artificial(?) systems such as robots or computers, they are situated at the level of switching circuits implemented in silicon.

Another example would be immune systems that can also be described by invoking the concept of memory by interaction of the organism with environment (see Edelman, 1992; Leuzinger-Bohleber and Pfeifer, 1998). In all these cases, it makes sense to use the concept of memory.

We can only describe on an observable level when and in what interactional context Ms M was able to remember a dream and afterwards a scene of her pre-school period. Our observations are exclusively based on the psychoanalytical situation (analysis of the behaviour, feelings and verbalisations of Ms M, own countertransference reactions etc.): we never had the possibility to 'look directly into the brain' of Ms M and thus cannot know which neural and neurophysiological processes had been activated when Ms M was able to remember the dream and the childhood episode. This differentiation seems to be simple. Nevertheless you often can find a confusion between the level of description of memory processes and underlying brain mechanisms in literature. We ourselves made this category error in the above-mentioned paper (1986). (PLEASE ADD TO REFS IT IS IN REFERENCES ALREADY: PFEIFER AND LEUZINGER-BOHLEBER, 1986)

Some authors (e.g. Edelman, 1989; Fuster, 1997) have tried to ferret out the mechanisms underlying memory in biological systems. It is important to underline that these mechanisms should not be seen as 'being' the memory, but rather as implementing those processes which, as the organism interacts with the environment, lead to behaviour that we try to explain by invoking the theoretical notion of memory.

Thus a clear distinction must be made between description of behaviour in terms of 'memory' and the brain mechanisms subtending this behaviour as illustrated in the focus box.

Focus box: Frame-of-reference: Description of behaviour vs. underlying mechanisms

A water fountain has a particular shape that can be described either with words, by drawing a picture or by approximating it using mathematical functions (as is done in computer graphics). It is obvious that this shape is nowhere 'represented' in the fountain in terms of a stored structure, even though to an outside observer, the water has a very definite structure (e.g. it looks like a bell). How, then, does this bell-shape come about? It is dynamically generated by ever-changing materials (different water molecules) and depends on factors such as water pressure, shape, diameter and direction of the jets, surface tension of the water, gravity and perhaps wind. In this sense, what appears as a structure to the outside observer is not the result of an internal representation, but is emergent from a number of different processes in the interaction with the real world. Thus, by merely observing and describing the shape, we cannot directly draw inferences about the underlying mechanisms. By analogy, the fact that a certain behaviour, e.g. the performance of a memory experiment, can be appropriately described in terms of

memory structures does not imply that these structures are actually represented somewhere in the brain of the subject.

How can we find out about the underlying mechanisms? We can, for example, try to influence the behaviour of the fountain in various ways: we can change the direction, the shape and the diameter of the jets; we can change the water pressure; or we can add chemicals to the water in order to change the surface tension. If these changes are performed systematically and the changes in the behaviour of the shape of the water carefully observed, we can infer a lot about the underlying mechanisms and their interactions. By analogy, in the case of memory, the search for the underlying brain mechanisms is not so much in terms of trying to find the memory structures, but by influencing the mechanisms in various ways and systematically observing the changes in memory performance we can draw inferences about the potential processes that—in the interactions among each other and with the environment—might bring about the observed structures. Imaging techniques, combined with different experimental methods—behavioural, lesions,(??) drug administration—can yield highly valuable pertinent insights, but they do not, in themselves, *constitute* these structures.

c) The developmental perspective

A third important aspect of the methodology of Embodied Cognitive Science is the developmental perspective. Conceptualising memory processes Embodied Cognitive Scientists do not attempt primarily to directly model the memory (or other) internal processes. The goal of their modelling is to define the developmental and learning processes and to explain the current behaviour resulting from these processes as the individual matures and interacts with the real world. The advantage of this perspective for modelling memory processes is that fewer assumptions have to be made about internal representations. Moreover, in this way, we are forced to work out the underlying mechanism that eventually—during development—lead to the observed behaviour. Much of the work in Embodied Cognitive Science is based on a developmental perspective, for example, constructing robots means implementing their ‘memory’ as a self-learning system. This means that the robots change their knowledge and ‘memory’ automatically by interacting with environment. As already mentioned, in contrast to analysing living organisms the researcher is able to ‘look into the robot’s brain’ and observe the continuous change of its neural network interacting with its environment. In other words the researcher can study precisely the influence of the developmental or learning history of the robot on his internal representation (neural network). According to the findings of this kind of research therefore memory has to be understood as a product of developmental processes in constant change (see below).

This perspective is compatible with psychoanalytic theorising where the developmental view is one of the underlying principles.

As described in the frame-of-reference section the analyst tried to progressively O.K. in reference to her history? PLEASE CLARIFY MEANING) understand the present behaviour of Ms M in connection with her biography, her idiosyncratic development. The ‘objective’ information of Ms M’s mother, that she had suffered from a severe postpartum depression and was treated with antidepressive drugs for eight months, proved to be helpful for precise observations in the clinical situation. Stern (1995) describes in detail the characteristics of the interaction of a baby with its depressive mother. With this empirical knowledge in mind I (M.L-B) was able to formulate concrete hypotheses about the possible ‘historical roots’ of the current behaviour of Ms M on the couch: her extreme bodily tension, the incapability to relax or to develop curiosity for the interactional partner, the ‘truth’, that I would not be able to do anything to reduce her tensions and pains because I would not be able to empathise with her etc. became quite plausible when I considered her possible early experiences with her depressive mother. Of course, it was important to carefully ‘test’ these hypotheses by further observations in the psychoanalytic sessions. More and more it became possible to share my hypotheses with Ms M and to make the supporting or rejecting of our hypotheses a common task.

Thus, the developmental perspective has, of course, additional relevance for psychoanalytic treatments but it is beyond the scope of this paper to also describe in detail the developmental processes of Ms M during psychoanalysis itself. We have only mentioned some of the changes in her memory during a short sequence of psychoanalysis: the memory of the scene with her father was the subject of critical reflection and of an emotional working through in many further psychoanalytic sessions. It was modified by the deeper understanding of its meanings, new detailed recollections and also by the psychoanalytic reflection on possible analogies of experiences of Ms M with her (depressed) father and those with her (depressed) mother compared to experiences when her parents probably had been in a better psychic state, recollections with the grandmother (who probably was a ‘good enough object’ for Ms M) and so on.

From our theoretical perspective it is relevant that memories are not seen as one to one retrievals of certain historical events but as a continuous changing process of the whole organism in interaction with its environment; or, to put it provocatively, each process of recalling is changing the memory although, at the same time, this process is not an arbitrary construction but a complex process approaching the historical truth of earlier developmental experiences (see below).

Let us take another example to further illustrate the view of an embodied memory considering all three of the above-mentioned basic theoretical topics:

We observe the 6-month-old infant Peter picking apples and newspaper from a table. Peter puts everything in his mouth—apples and newspaper. After a while he only grasps the apples leaving the newspapers aside. From our perspective as observers of this

scene we suppose that Peter has learnt from experience and ‘remembers’ that apples taste better than newspapers. Therefore, he now prefers to taste apples. Analysing the infant’s behaviour we (the observers) postulate that Peter selects apples by reference to his former experiences: according to the observer he has functioning memory at his disposal. We have defined memory from an ‘outside’ perspective—observing the infant’s behaviour—and not by looking into his brain (see *memory as a theoretical construct* and *frame-of-reference problem*). It is an attribution to the infant as a whole (we evaluate his whole behaviour), not of one part of the infant, says its brain. This means that we do not have to postulate any kind of internal representation in order to describe his behaviour (respectively his memory).

Another important observation is that the infant has developed categories: he now can differentiate between apples and newspapers.

We only want to point to the fact that Peter is developing ‘procedural memory’, according to many memory researchers the dominating form of memory in the first years of life. Procedural memory cannot become conscious in later periods of time (see Tulving, 1985; Main, 1991; Sandler and Sandler, 1997; Fonagy and Target, 1997; Köhler, 1998(KOHPLET 1998 IS OKIN REFS—PLEASE CONFIRM WHICH IS CORRECT); Crittenden, 2001; Shevrin, 2001). Many authors postulate that the different memory systems, e.g. procedural memory, episodic memory, declarative memory, autobiographical memory, are more or less independent memory systems. This thesis has a great clinical relevance because, in the eyes of some of these authors, e.g. early experiences are practically exclusively ‘stored’ in procedural memory and cannot be integrated to autobiographical memory which is developed much later, after the fourth year of life. As the example of Peter illustrates we think that a strict separation of the different memory systems is not justified: Peter not only has developed procedural memory but also, as we will discuss below, categories which can be seen as one base of the (later) development of declarative memory. You can also plausibly describe his experiences by the concept of sensomotor action schemas (Piaget) or, as Daniel Stern (1995) postulates it, by ‘schemata-of-being-with a significant other’ (probably his admiring mother!) which are an important stage in the early development of the self and, as Stern postulates, remain important for an integrated state of the self even in later periods of life (e.g. after the development of a reflective self etc.). In other words of course these early learning processes create mostly procedural memories and develop before the acquisition of language or mentalising functions that are important for declarative and autobiographical memories. Nevertheless for us it seems plausible to focus more on an integrative view and the continuity of psychic development than on discontinuity (e.g. the complete independence of the different memory systems).

Categorisation is a fundamental function of memory, a prerequisite for adequate behaviour. As discussed above, memory theories of Classical Cognitive Science use

recognition programmes (demons) for this purpose (we used the example of recognising a piece of music). One of the big problems of this approach is that all the categories have to be defined by the designer of the model 'from the outside', so to speak. In an environment that is continuously changing, in which new situations occur and objects appear, this is not always possible. If we look at the example of Peter, we are immediately confronted with the difficulty of specifying what a category 'defined from the outside' would mean. Let us for the sake of argument assume that the category 'newspaper' had been somehow predefined (e.g. by his mother) and that now Peter is given a magazine instead of a newspaper. The static view of categorisation would not work because the magazine leads to different patterns of sensory stimulation than the newspaper. Moreover, Peter would need a homunculus in his brain, which decides in which situation which information has to be retrieved and applied. As our example illustrates, obviously memory in a living organism - as - Peter must function differently (OKPLEASE CLARIFY MEANING). Without any difficulties Peter can use his category 'newspaper' for recognising the 'magazine' and adapting the old category to the new stimuli. He can solve the theoretically ambitious problem to decide whether certain stimuli ('magazine') belong to the same category as 'newspaper' (category: paper object with letters) or whether the new situation forces him to develop a new category (e.g. if he grasps a soap he has to learn to differentiate between 'tasty', 'neutral' and 'disgusting' objects). This theoretically difficult problem is solved, if memory is conceptualised as a dynamic, constructive and interactive process.

Neural implementation of memory as a dynamic constructive process

Working out the biological basis of categorisation in the real world is precisely one of the main goals of Edelman (1987, 1992). Edelman's ideas are of interest not only because of his focus on processes of self-organisation which provide the organism with the required adaptive potential, but because he considers memory from an embodied perspective. The notion of 'memory as recategorisation' is based on processes of sensory-motor co-ordination, which, in a very direct sense, anchor memory, or its manifestation in behaviour, in the interaction of an individual with the environment.

We want to pick up two central ideas of Edelman here: sensory-motor co-ordination and value systems. The general framework proposed by Edelman suggests that the results of motor activity are an integral part of categorisation.

While sensation and perhaps certain aspects of perception can proceed without a contribution of the motor apparatus, perceptual categorisation depends upon the interplay between local cortical sensory maps and local motor maps. The strongest consequence of this assumption is that categorisation cannot be a property of one small portion of the nervous system (1987, p. 210).

Thus, categorisation involves not only the brain but also the sensory-motor apparatus, a key implication of the principles of sensory-motor co-ordination. The

essential mechanism of categorisation in Edelman's framework is a parallel sampling of the environment by multiple sensory maps within the same modality and between different modalities. This sampling is a process of sensory-motor co-ordination in which various maps pick up different, but temporally correlated, signals from the environment. These correlations play a fundamental role in categorisation (see below).

Edelman illustrates the principle of sensory-motor co-ordination by the following graph:

*** Insert figure 4 about here **

(Development of neural networks in ontogenesis with commentary to Figure 9-1, Edelman, 1992, p. 84, explanation of the graph included) (IS THIS FIGURE 4 CAPTION OR TO BE DELETED? PLEASE WAIT FOR ROLF PFEIFER TO ANSWER- HE WILL MAIL THE FIGURES TO YOU)

Thelen and Smith point out that 'this perfect temporal association of multimodal information is perhaps the only perceptual invariant that spans all ages, contexts and modalities. We believe, with Edelman, that this correlation is the primary link between the mind and the world' (1994, p. 149). This is a central point in embodied memory theory: Sensory-motor co-ordination structures the high-dimensional sensory space by inducing regularities. The temporal correlation of signals in the neural maps related to the different sensory modalities, generated by the interaction with an object, is the most basic example of such regularities. Which of these patterns of correlations are chosen or selected in the process of categorisation is modulated by a value system. Value systems are basic evolutionary adaptations that define broad behavioural goals of an organism. For example, if an organism (like Peter) succeeds in grasping an object or sticking it into its mouth, a value signal is generated that enables the association of the activation in the neural maps corresponding to the different sensory and proprioceptive modalities. In this way the organism is capable of generating categories on its own as it interacts with the environment. Looking once more at our example: Peter learns to differentiate between apples and newspapers by picking up apples and newspapers and sticking them into his mouth. Both sequences of events lead to different activations in the different neural maps (visual, haptic, auditory, and proprioceptive), which are then, through the modulation of the value system, associated with each other. If a new situation (e.g. grasping a soap) affords this, a new category has to be developed ('soap' compared with 'newspaper' compared with 'apples'). Because there is no limit to the patterns of sensory stimulation, new perceptual categories can be formed if they have distinct behavioural consequences. These associations between the different neural maps are the biases that shape the behaviour of the organism in a novel situation. In this sense, they can be

viewed as the neural basis of categorisation and thus of memory. It is interesting to note that with each sensory-motor co-ordination these associations are changed. Edelman speaks of a never-ending process of recategorisation, which allows the organism to adapt constantly to new situations applying knowledge gained in past experiences.

This view leads to a definition of memory that sharply contrasts with the traditional view of memory as stored structures: ‘memory is the enhanced ability to categorize or generalize associatively, not the storage of features or attributes of objects as a list’ (Edelman, 1987, p. 241). Memory is defined as the ability of the whole organism to recategorise, a capacity that always stems from sensory-motor co-ordination processes. A relation notion of memory is put forward by Clancey’s definition: ‘Human memory is a capability to organize neurological processes into a configuration which relates perceptions to movements similar to how they have been coordinated in the past’ (1993, p. 253). A detailed discussion of related memory concepts can be found in Pfeifer and Scheier (1999, pp. 503–534).

In summary, Edelman’s notion of memory is based on processes of sensory-motor co-ordination, i.e. it includes sensory and motor processes. The motor processes, but also the kind of sensory stimulation to be processed by the neural system depends on the specifics of the sensors (their physical characteristics and shape and their position on the organism (see ‘apple’ and ‘newspaper’ in the example mentioned above) *and* the motor system. As mentioned earlier, the buzzword used in the modern Cognitive Science literature is embodiment. It is important to empathise that categorisation, and thus memory, is not only a matter of internal processing of sensory signals, but of sensory and motor processes. It is hard to overstress this fundamental point: perception is no longer viewed as an event of mapping a sensory stimulation (e.g. a stimulation on the retina) on to some kind of internal representation, but as an act that involves the senses as well as the motor system. Although this point was made over a hundred years ago by American philosopher and psychologist John Dewey (1896), it has not really been taken seriously. The implications for our understanding of memory are enormous, especially in clinical contexts. All of a sudden, memory is no longer a box where conscious or unconscious memories are stored from where they can or cannot be retrieved, but a characteristic of a biological physical organism that interacts with the real world. Manifestations of memory can always be traced back to sensory-motor interactions and as a consequence sensory-motor processes play an essential role in memory.

We conclude this section with a comparison of embodied notions of memory and the traditional ones that are based on the computer metaphor (Edelman, 1992; figure 5).

*** Insert Figure 5 about here*** (Edelman, 1992, p. 103)

‘Classical memory models’ presuppose a precise storage of knowledge, which implies that they are not able to explain a whole range of phenomena (application to new situations, creation of new categories etc.). By way of contrast the storage of knowledge in dynamic models is not as exact, but by this very quality it brings about an optimal ability to generalise and adapt to new situations. Memory is thus seen as a constructive, adaptive process of the whole organism interacting with the environment connecting—in a constant process of recategorisation—knowledge gained in a past situation with analogous new situations by sensory motor co-ordination.

We finally want to underline that from this perspective it is entirely obvious that the concepts of sensory-motor co-ordination, categorisation, learning, memory and perception are tightly intertwined and cannot be separated clearly from one another. This is because the underlying mechanisms responsible for these phenomena are largely shared. . Conceptualisation of early memory processes: a preliminary comparison between the current biologically oriented, embodied memory research and clinical psychoanalytical research

Let us illustrate how this theoretical thinking can enhance our understanding of memory processes, e.g. remembering early experiences in a psychoanalytic situation looking at our case material again. It can, in our view, be integrated with our psychoanalytical theorising plausibly.

To summarise briefly using our psychoanalytic concepts: the memory of infantile object relations with depressed parents were evoked in the transference situation. During the first two years of treatment relevant transference-patterns of the traumatic early object relations and central unconscious fantasies were unfolded—a process (determined by projections and projective identifications etc.) which the analyst did not consciously understand yet, but to which she responded by intensive countertransference feelings and finally with the impulse to abort the psychoanalysis of her patient. After supervision it was possible for her to make these unconscious object-relation patterns and fantasies conscious and to regain interest in the psychodynamics of her analysand, in other words to regain an intermediate space, as Winnicott calls it, which is a presupposition for visualisations and verbalisations of sensory-motor pre-verbal experiences but also for fulfilling therapeutic functions like ‘containing’ and ‘holding’. The analysand probably recognised these changes in the analyst’s attitude towards her and remembered her second dream in the following session. (We suppose that the different recognition of the analyst being more relaxed and curious to understand the patient, able to empathise with her emotionally, might have evoked another transference constellation, perhaps a ‘grand-mother’ transference connected with more trustful experiences with a ‘good-enough’ object. This could be one reason why Ms M was then able to remember a dream feeling

enough confidentiality to tell it to her analyst.)

The verbalisation of one of her central unconscious fantasies about human relations ('a fight over life and death'), referring to the patient's dream motive of her analyst giving her a dangerous injection, lead to her remembering of the infantile scene with her father in which he devaluated her self-esteem traumatically. The confrontation with a contradiction in her memory (a dead brother?) made the analysand investigate her early biography which lead us now to presume that the remembered scene also had the quality of a screen memory: the verbal devaluation and denigration of the patient by her (depressed) insensible father was supposedly connected in her memory with her chronic feeling of being devaluated by the depressive mother during her first year of life unable to empathise in a 'good enough way' with her baby's basic needs. These early trauma in the object relation with her primary object had, as I have discussed in the mentioned clinical paper (Leuzinger-Bohleber, in press), a determinate influence for the early development of her self- and object-representations and her lack of psychic integration of her archaic aggressive and libidinal impulses.

But how had these early experiences with a depressive primary object during the first year of life 'been kept in memory of Ms M'? Does interdisciplinary research help us answer this question? Is this the right question in the first place?

Let us just discuss briefly our position emphasising just two central points:

a) Historical versus narrative truth: an inappropriate polarisation reflecting developmental memory processes

As we have tried to show: current memory research points out that memory processes are not to be conceptualised by analogy to the computer model of storing and retrieving information in a static and unchangeable sense. Memory always consists of new and constructive processes in the 'here and now' of a current interactional situation (system—environment—interaction) which is indispensable for constituting memories. At the same time this constitution of memories is not arbitrary because the way the current system-environment interaction is structured and the way the sensory-motor patterns are interpreted are determined by the individual's history. Memories are constructed by analogy to previous situations with similar sensory-motor patterns. Although this physical stimulation is always subject to interpretation, depending on the individual's history, the sensory stimulation itself is still 'objective' and not arbitrary. This is a consequence of embodiment: sensory-motor states, at least theoretically, are measurable physical processes; the sensory-motor co-ordination is given by the way the neural maps are integrated in the organism, which is, again, objective. In this sense memories result from constructive processes on the one hand but on the other hand are influenced by the 'historical truth' which means that, for example, the historically first constituted processes dealing with a (traumatic) situation which constrains the

recategorisation of the new analogous situation. In this sense recategorisations in later interactional situations are related to the original trauma. Metaphorically we therefore could postulate that memory is always based on new and idiosyncratic narratives taking place in current interactional situations but contains at the same time traces of the 'historical truth'. As we have mentioned briefly above, the 'objective' biographical information (severe postpartum depression of the mother etc.) proved to be helpful in the psychoanalytic sessions to recognise finally these traces of the 'historical trauma' in the current behaviour of Ms M (e.g. seeing the analogies between her current psychosomatic and emotional reactions and those of a baby interacting with a depressive mother (see Stern, 1995)). Thus, we think that for a stable therapeutic change of our patients both approaches are indispensable: understanding the idiosyncratic ways of unconscious functioning (see Bollas, 1992; Green, 1999; Hinshelwood, (HINSELWOOD IN REFS—PLEASE CONFIRM WHICH IS CORRECT OK)1991; Sandler and Sandler, 1997) and the attempt to understand the highly individual, biographical (historical) truth in the sense of understanding the 'specific, undeniable reality of trauma' (see also Bohleber, 2000; Fischer and Riedesser, 1998; van der Kolk, McFarlane & Weisaeth, 1996).

To repeat our thesis: experiences and memories have an objective and a subjective aspect. The objective one is given by the patterns of sensory stimulation in a particular sensory-motor interaction, which is, in principle, physically measurable. The subjective aspect refers to how the individual experiences associated with these patterns, which is the result of an interpretation—a constructive process—are determined by the individual's history. The sensory stimulation to which the organism is 'objectively' exposed is not a matter of passively undergoing physical stimulation but rather it is generated as the organism interacts with its environment. As a consequence of this interaction the resulting patterns of sensory stimulation are structured and contain correlations that can be easily interpreted by neural mechanisms. The types of interactions in turn are a result of developmental processes. Again, the developmental processes strongly depend on the richness and structuredness of the sensory stimulation. Thus, it is the sensory-motor coupling which provides the basis from which the developmental processes can be bootstrapped.

Deficiencies in the early sensory stimulation—as for example in the early interactions with a depressive mother—therefore have a detrimental effect on development: because the sensory stimulation is systematically impoverished as for example described by Stern (1995), the 'raw material' (so to speak) for the neural system is deficient and does not lead to the development of appropriate sensory-motor schemas which in turn lead to inappropriate motor behaviour being then not capable of generating appropriately structured and rich sensory stimulation. Processes of categorisation will also be impaired (e.g. Medea fantasy, see above). If, in contrast,

‘good enough’ interactions with the environment are in the form of sensory-motor co-ordination (as, for example, implemented by the sensory-motor maps described by Edelman), they lead to ‘good’ sensory stimulation, i.e. correlations that can be easily processed by the neural system. Behaviour based on sensory-motor co-ordination is coherent and can be described in terms of schemas. These considerations are strongly based on the fact that the organism is embodied since the ‘raw material’ for the neural system is generated by the physical organism in the interaction with the real world.

As a consequence we would expect in patients like Ms M with an early interaction with severely depressed mothers not only affective deficiencies but also cognitive ones related to their partial disability for categorisation.

In the intensive interaction of Ms M with the analyst these deficiencies in categorising and in the inner object relations of the analysand became observable and thus opened a possibility to PROGRESSIVELY (successfully? or as a progression? PLEASE CLARIFY MEANING) understand in detail their roots, in other words the unconscious recollections of past experiences with the primary object. We thus understand now the motoric hyperactivity of Ms M., her chronic not feeling well psychobiologically during the session, and her panic anxiety when confronted with passivity and silence in the session according to our memory theory as follows: the sensory-motor and affective experiences of lying on the couch were, as the analysand described it once, a bodily experience of dependency, powerlessness and a feeling of being at someone’s mercy, which probably reactivated unconscious memories of analogous embodied sensations of early infancy in her primary object relations. Her compulsive way of speaking without any pauses and without any affective modulation in her voice now seems to us also part of such unconscious memories. Once she told her analyst in a session that her mother usually ‘talks her to death’ on the phone and does not allow her to interrupt her in any way or to express anything herself. Thus she unconsciously seemed to add some of the stimuli originally connected to the traumatic interaction with this ever-speaking, non-sensitive depressive mother in the current interaction with the analyst. We postulate that the analyst was able to perceive the ongoing sensory-motor co-ordination of the analysand during the session with growing intensity and reacted to them (unconsciously) by inner recategorisation processes initiating finally similar reactions as Ms M probably (procedurally) remembered on the couch. My (M. L.-B.) perception of an extreme tension in my body, being flooded by affects and unpleasant sensory-motor reactions (e.g. colics), the lack of a dialogue between us and finally my feeling of being annihilated can thus be seen as ‘products’ of our intensive, embodied interaction during the psychoanalytic sessions and my own inner processes evoked by the interaction with my patient. Thanks to supervision it finally was possible to develop hypotheses on the memory of Ms M in the sense that I was able to explain her current behaviour on the couch by the probable past behaviour in her former

pathogenic object relation with her early mother. Communicating these hypotheses to Ms M and trying to ‘test’ them afterwards together in the sessions by gaining further information probably initiated a process of recategorisation within Ms M, for example, finally modifying her ‘false’ unconscious categorisation of being a destructive, unlovable self etc.

In other words: in the psychoanalytic setting the schema of ‘being with others’ (with a depressed ‘dead mother’) was not ‘evoked’ like a stored knowledge structure from early mother–child interactions (in the sense of the above-mentioned TOP) but actively ‘constructed’, unconsciously interpreting the sensory-motor-stimuli that resulted from Ms M lying on the couch interacting with her analyst—a situation which had similarities to the original stimuli in the early mother–child interaction and thus ‘triggered’ analogous unconscious interpretations, ‘fantasies’.

One further comment, one of the questions we asked in our Introduction was in what specific transference situations do new memories occur? And why? Let us briefly try to give an answer. Analogously to the previously discussed hypotheses we suppose that it was the different embodied interaction with her analysts after the supervision that enabled Ms M to develop the confidence to dream, respectively to remember a dream and to tell it to her analysts. Probably she had recognised that her analyst was more relaxed, filled with professional curiosity and attention, and had an emotional positive attitude towards her which might have created a sensory-motor stimulation that was similar to former interactions with a ‘good enough object’ (perhaps her grandmother or her parent in a non-depressed state). Thus she unconsciously remembered non-traumatic experiences with a responsive, sensitive object who is able to understand in a ‘good enough way’ what Ms M feels and wants to communicate. These memories enabled her minimally to trust the analyst and to dare to tell her a dream and a central childhood memory.

b) Transference, Embodiment and System-Environment Interaction

These (unconsciously) ongoing memory processes in the psychoanalytical situation enabled, as we tried to show, observations of transference and countertransference reactions which had been central for our growing understanding of unconscious procedures and fantasies (implicit memories). In other words the (unconscious) perception of certain sensory-motor states and processes ‘triggered’ the sensory-motor reactions and the (unconscious) fantasies of the analyst in the analytic situation and finally enabled the analyst (with the help of supervision) to reflect on these countertransference reactions. In other words the psychoanalytical interaction was indispensable for the discovery of the unconscious determinants of Ms M’s symptoms and psychopathology.

Our thesis is that the traumatic sensory-motor experiences of the early interactions

with the depressive primary object still unconsciously determined—in the sense of an implicit, embodied memory—the current interactions of Ms M including the interaction with her analyst. To underline this point: it was the unconscious repetition of the interpretation of current sensory-motor states which created the countertransference reactions in the analyst which resembled strikingly the ones of a depressive object feeling helpless, despaired and destructively aggressive wishing to free itself of the burden of the baby (respectively the analysand). From a theoretical perspective it is important that the knowledge from the past object-relation experiences was mostly transmitted by what other memory researchers call ‘procedural memories’. As Clyman (1992) postulates psychoanalysis offers the chance to make implicit procedural memory contents explicit by analysing them in the transference. This process is connected with ‘insight’, which means the emotional experience of a new, declarative information enabling afterwards to change emotions and behaviour (‘procedures’). Thus a long-lasting therapeutic process to ‘making unconscious conscious’ can be initiated enabling Ms M finally to integrate procedural with autobiographical memory. To characterise this process metaphorically: understanding precisely the unconscious traces of their own biography enables our patients to regain their idiosyncratic life history.

We also have attempted to illustrate how embodied memory research might explain remembering of traumatic childhood experiences as occurring in a new interaction with a ‘meaningful other’ (that means in the transference to the analyst). A situative, constructive understanding of interactions is the precondition for remembering! Remembering is dependent on a dialogue in the inner and outside reality with an object, an interactive process, an integrative, ‘embodied’ experience between two persons. Ms M would not have been able to remember alone for herself lying in her bed at home (see also results from recent trauma research, e.g. Brenneis, 1994; Brooks-Brenneis, 1996; Kihlstrom, 1994; van der Kolk, McFarlane and Weisaeth, 1996; Leuzinger-Bohleber, Pfeifer and Röckerath, 1998 (PLEASE ADD TO REFS OK); Person and Klar, 1994).

Therefore it seems to us that the clinical research of psychoanalysis of the last decades, which postulated more and more radically that only a working through of traumatic experiences in early object relations in the transference lead to a structural change within our patients, gains interdisciplinary support by current biologically oriented memory research. It seems that these findings of the neurosciences and Embodied Cognitive Science prove to be ‘externally coherent’ (Strenger, 1991) with psychoanalytic insights. According to these findings we can summarise: first, remembering is not the activation of static stored information, but a highly dynamic process of recategorisations in the here and now of the transference; remembering is dependent on the system-environment interaction (inner or real dialogue with objects) and thus on embodiment. It is sensory-motor and not only internal (in the sense of purely mental) because also during internal processing we have sensory-motor

stimulations (see Gray and Singer, 1989); third, remembering therefore is dependent on the construction of 'narrative truths' in actual or actualised object relationships. At the same time it can be seen as a constructive, creative process of approaching 'historical truth'. Edelman (1989), Fuster (1997), Pfeifer and Scheier (1999) and others argue convincingly that social experiences are anchored in embodied structures, i.e. in biology; memory always has a subjective and an objective side. The subjective side is given by the constant interpretations of one's own history; the objective side by the neural patterns generated by the sensory motor interactions with the environment; and, finally, remembering is a precondition for a process of recategorisation of unconscious traumatic experiences and therefore for a structural change of behaviour.

Summary

How can very early experiences-as, for example, traumatic interactions with a depressive mother-influence the psychic state of adult women patients? How does early and mature memory work? These questions are highly relevant for psychoanalytical practice. Can interdisciplinary memory research add some dimensions to a clinical understanding of psychic functioning based on unconscious memories, fantasies and 'truths'?

We have argued that we, as practising clinical psychoanalysts, often are not aware of the fact that our clinical understanding is influenced (without our knowledge) by the memory theories we have at the backs of our minds (see also Hirshberg, 1989). In a critical review of the paper we published in 1986, when we applied concepts of Classical Cognitive Science to some sequences of a psychoanalysis, we suggested that the metaphor underlying 'Classical Cognitive Science' (which is based on the computer metaphor) is not suited for application to the mechanisms of human memory as a biological system. In the brain there is no 'store' from which memory structures are retrieved, but memory is a theoretical construct explaining current behaviour by reference to events that have happened in the past. Memory is not only a function of the brain but also an aspect of the whole organism.

During the last decade alternative conceptualisation to 'memory as stored structures' have been developed in 'Embodied Cognitive Science' which, in our view, may offer some integrational theoretical perspectives for the booming field of empirical memory research. Not all of their ideas are historically new: Dewey, Bartlett and Piaget have already criticised the storehouse metaphor for memory years ago. In our paper we have referred briefly to some of the basic arguments on emphasising the necessity to consider memory as a theoretical construct, the frame-of-reference problem and a developmental perspective. In our view all these theoretical arguments are relevant for the ongoing memory research because they try to differentiate clearly between a descriptive-

psychological and a neuroanatomical and neurobiological level explaining and describing memory processes (see the metaphor of the water fountain).

We have illustrated an alternative model of memory, suggesting a metaphor of memory as a function of the whole organism, as a complex, dynamic, recategorising and interactive process, which is always 'embodied', in other words based on actual sensory-motor experiences, and manifests itself in the behaviour of the organism. Certainly, this metaphor is not as yet 'tangible' enough. Further research is needed to find a more 'compelling' metaphor. Edelman, for example, compares the functioning of memory more with a storm in the jungle than with a computer: it is a highly dynamic, idiosyncratic and complex process never functioning twice in exactly the same way, always rewriting 'old experiences' in a new psychic construction. We have tried to illustrate that these alternative concepts of memory can be helpful for a deeper understanding of the functioning of memory especially of the way early experiences, for example, with a depressive primary object, are contained in the memory of a certain individual patient. These conceptualisations seem to support the clinical findings that each patient has his very characteristic, 'subjective' way to react on 'real traumatisation', e.g. to build up his specific imagos of the traumatising object in the unconscious. In the sense of the *'Nachträglichkeit'* the original experience of trauma is rewritten again and again or, to use the terminology of Edelman, is constantly recategorised in new interactions. Therefore the 'original historical truth' cannot be reconstructed in a one-to-one sense, like retrieving certain information from storage in a computer. The 'truth' has been rewritten and reformed ('reconstructed') by new experiences time and again. On the other hand we have also tried to illustrate that the historical event, for example, the specific trauma dealing with a depressive mother in a certain period of life, cannot be evaded but has to be considered, trying to understand the 'historical traces' hidden in the current interactional behaviour of our patients (see the role of the 'objective' information of the postpartum depression of the mother of Ms M etc.). Trying to understand biographical idiosyncrasies of our analysands adds certain dimensions to our clinical understanding of the specific psychodynamics of our patients. The original trauma and the specific reactions and inner psychic 'constructions' which are built into unconscious fantasies form the constraints for the specific recategorisations in new interactional situations.

We have also pointed out that the new discoveries in memory research seem to support the clinical psychoanalytic evidence of the last decades that therapeutic changes do not come about merely by means of uncovering the traumatisations of early infancy ('archaeology metaphor'), by 'pure insight in the head of the patient', but that working through in the transference relationship to the analyst (including the sensory-motor and affective experiences in the therapeutic interaction in the sense of 'embodiment') is the decisive factor. Thus the radicalisation of the relevance of transference for therapeutic

change finds interdisciplinary support. It also seems important to us that according to this current memory research psychic processes are always anchored biologically and neuroanatomically and therefore have an 'objective' side. Real experiences in the very early childhood (including the intrauterine stage), as Edelman, Fuster, Pfeifer & Scheier and others postulate, even seem to influence the building up and the later modifications of our neuronal structures. Therefore these conceptualisations make it plausible that the needs and conflicts that arise during early socialisation should be so persistent and determining and why psychoanalyses that change structures need time. After all, changes of biological processes need their own time.

Within the framework of this paper we have not been able to discuss the basic and important problems of philosophy of science connected with the interdisciplinary dialogue between psychoanalysis and the neurosciences or Cognitive Science (see Leuzinger-Bohleber, Mertens and Koukkou, 1998, and publications in the new journal *Neuropsychoanalysis*). We had to restrict ourselves to just one practical example of interdisciplinary research introducing an 'embodied model of memory' which in our view seems to be inspiring for our clinical understanding of remembering in the psychoanalytic situation and deepens our theoretical knowledge. Of course, many relevant questions (for example, the detailed connection of sensomotoric (sensory-motor) interactional and declarative memory) remain open and wait for further interdisciplinary research.

Even after years of intensive, concrete co-operation, we personally consider the dialogue with the neural sciences and Cognitive Science to be as much of an exciting challenge as well as a tightrope walk for psychoanalysis as ever before: On the one hand in our view it seems necessary for the results of psychoanalytic research and psychoanalytic theories based on them to attain 'external coherence' (Strenger, 1991) and for a discourse with the scientific community to take place. On the other hand there also seems to be the danger for psychoanalysis of an overhasty adjustment to viewpoints which are culturally and 'scientifically' accepted but foreign to our profession. Using a clinical example from a psychoanalysis we tried to illustrate that clinical psychoanalytical research cannot be replaced by any other form of research on the one hand but that interdisciplinary or empirical research nevertheless has proved to be helpful for adding some dimensions to our understanding of complex unconscious psychic functioning as e.g. early forms of memory on the other. Therefore we postulate that hard and open scientific controversial discussions within the psychoanalytic community and with the scientific world in general will be of great importance for the future of psychoanalysis as a creative clinical theory as well as an innovative science.

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Translations of summary

La mémoire a toujours été un sujet central à la théorie et pratique psychanalytique. Des développements récents dans les sciences neurales et cognitives montrent que les notions traditionnelles de mémoire basée sur des structures emmagasinées qui sont aussi souvent sous-jacentes à la pensée psychanalytique ne peuvent expliquer certains phénomènes fondamentaux et il est donc nécessaire de les redéfinir. Dans cet article, l’auteur montre que la mémoire peut tout d’abord être conçue comme une construction théorique qui explique le comportement courant en se référant aux événements qui se sont déroulés dans le passé; deuxièmement, la mémoire ne doit pas être conçue comme des structures emmagasinées mais comme une fonction de l’ensemble de l’organisme, comme un processus interactif et re- catégorisant, dynamique et complexe, qui prend toujours ‘corps’; et troisièmement, la mémoire a toujours un coté subjectif et objectif. Le coté subjectif est donné par le passé de l’individu, le coté objectif par les patterns neutres que génèrent les interactions sensorielles moteur avec l’environnement. Ceci implique que les vérités ‘narratives’ (subjectives) et ‘historiques’ (objectives) doivent être prise en compte dans le changement psychique stable, comme l’illustre le matériel clinique abondant qui provient de la psychanalyse d’un patient borderline stérile et psychogénique.

Erinnerung ist immer ein zentrales Thema in psychoanalytischer Theorie und Praxis gewesen. Neuere Entwicklungen in den kognitiven und Neuro-wissenschaften legen nahe, dass traditionelle Begriffe von Erinnerung, auf gespeicherten Strukturen basierend, die oft auch psychoanalytischem Denken zugrundeliegen, eine Anzahl von fundamentalen Phänomenen nicht erklären können und daher revidiert werden müssen. In diesem Artikel äussern die Autoren die Ansicht, dass Erinnerung erstens als ein theoretisches Konstrukt gesehen werden muss, das gegenwärtiges Verhalten in Bezug auf Ereignisse, die in der Vergangenheit passierten, erklärt; zweitens, Erinnerung kann nicht als gespeicherte Strukturen gesehen werden, sondern als eine Funktion des ganzen Organismus, als ein komplexer, dynamischer, wieder kategorisierender und interaktiver Prozess, der immer ‘verkörpert’ ist; drittens, Erinnerung hat immer eine subjektive und eine objektive Seite. Die subjektive Seite wird von der Geschichte des Individuums gestellt, die objektive Seite von den Nervenmustern, die von den sensorischen Motorinteraktionen mit der Umgebung hervorgebracht werden. Daraus lässt sich

schliessen, dass sowohl die ‘erzählte’ (subjektive) als auch die ‘historische’ (objektive) Wahrheit in Betracht gezogen werden müssen, um eine stabile psychische Veränderung zu erreichen wie dies anhand von ausgiebigem klinischen Material aus der Psychoanalyse eines psychogenen sterilen borderline Patientens gezeigt wird.

La memoria siempre ha sido un tema central en la teoría y la práctica del psicoanálisis. Los adelantos recientes en la ciencia cognitiva y la neurociencia sugieren que las nociones tradicionales de la memoria, basadas en las estructuras almacenadas, que con frecuencia también subyacen al pensamiento psicoanalítico, no son capaces de dar cuenta de una cantidad de fenómenos fundamentales; por esto, deben revisarse. En este artículo, los autores sugieren que la memoria se conciba, primero, como construcción teórica que explica el comportamiento actual con referencia a eventos ocurridos en el pasado; segundo, la memoria no debe concebirse como estructuras almacenadas, sino como función del organismo entero, como proceso complejo, dinámico, que establece categorías una y otra vez, y es interactivo, que siempre está ‘encarnado’; y tercero, la memoria siempre tiene un lado subjetivo y un lado objetivo. El lado subjetivo lo da la historia del individuo; el lado objetivo lo dan los patrones neuronales generados por las interacciones motrices sensoriales con el medioambiente. Esto implica que la verdad, tanto ‘narrativa’ (subjetiva) como ‘histórica’ (objetiva) deben tomarse en cuenta en la obtención de un cambio psíquico estable, tal como lo ilustran los materiales clínicos extensos tomados de un psicoanálisis con un paciente fronterizo estéril psicogénico.

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