



Summary

The paper introduces a physiologically rooted idea to understand the differential nature of explicit *versus* implicit memory. The first part of the text deals with this perspective on memory (retrieval). From the insight, some important questions came up. They are outlined, suggesting a special role of body stimulations for psychic functioning. The second part of the article will look at the processes from the other direction, of memory construction (concept formation). Converging findings are outlined indicating the prerogative of interpersonal touch for cognition (formation) in line with psychic and organic well-being in the life span. Finally, an extended view on the basic element of concepts (elementary contrasts, coming from the new memory understanding outlined in the beginning) will be introduced. It is the starting point to look at and understand naturalistic situations of children's concept learning. Children (and adults) learn concepts (or: form memories) by covariation and association in the frame of bonding body contacts. As a conclusion, the body approach to memory retrieval and formation fits the biological notion of reproduction. This article points to the governing role of close and tender relationships, as well as body methods for psychic and organic health, well-being and healing.



self-hug-jacket

Love and friendship: why body methods enable organic and psychic health

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'This multitude of ideas, existing absolutely, yet clinging together, weaving an endless carpet of themselves, like dominoes in ceaseless change, or the bits of glass in a kaleidoscope, - whence do they get their fantastic laws of clinging, and why do they cling in just the shapes they do?'

William James, p. 3 Volume 1¹

'Romeo wants Juliet as the filings want the magnet; and if no obstacles intervene he moves towards her by as straight a line as they. But Romeo and Juliet, if a wall be built between them, do not remain idiotically pressing their faces against its opposite sides like the magnet and the filings with the card. Romeo soon finds a circuitous way, by scaling the wall or otherwise, of touching Juliet's lips directly. With the filings the path is fixed; whether it reaches the end depends on accidents. With the lover it is the end which is fixed, the path may be modified indefinitely.'

William James, p. 7 Volume 1¹

Memory Retrieval

I had studied physiology, theory of neuronal processes, learning and concept formation for some time. Important books were 'Learning' by David Lieberman² and 'Biopsychology' by John Pinel³. I also had attended a seminar held by Josef Lukas about concept formation. Other **readings** of the time must have influenced my approach: 'Siddhartha' by Hermann Hesse, 'Nausea' by Jean-Paul Sartre, 'To have or to be' by Erich Fromm, as well as 'Wirklichkeit der Seele' (Essays) by Carl Gustav Jung.

Back then a study about memory processes raised my interest⁴. The study included two groups, people with Korsakow syndrome and healthy controls. Both groups were shown pictures in a first trial. In a second trial a few days later, the people with **Korsakow syndrome** could recognize recurring pictures from the first time nearly as well as the healthy control participants. But in contrast to the healthy controls, the Korsakow patients did not *remember* the experience of the first trial. The patients' identification of a recurring picture was solely based on a mere *feeling of familiarity* towards it, as they reported. What the patients still had is called recognition memory. It is a type of implicit memory which can appear in different sensory and in motor function. What the patients lacked, the holistic memory of the first event, is called explicit or declarative memory. Korsakow syndrome is signified by a damage of the hippocampus, a structure known to be pivotal for declarative memory processes.

Normally, we **experience all inputs** of a current situation: smells, colours, characteristics of the room, of the people, the feel of the seat, the voice of the experimenter. All these inputs together make up a particular situation. Even if we always attend a certain part of a situation more than the rest, we're

taking a record of all the inputs. And we connect the inputs as they occur together. All the inputs we experience in one moment are bound together. But they are flowing and changing over time. From moment to moment, some parts may change, others remain: When I look up from the screen out the window, my visual input is changing, but still, I am sitting on my chair, feeling my butt on the seat, and my arms on the rest. When I get up to make myself a tea, these sensations will change, but still, I am in my room, with the same floor seen with my eyes. Then, I 'remain' walking while my surroundings change into the kitchen. And so on. The numerous connected **patterns** of perception and thoughts we live through **overlap** in time. They never change completely from one moment to the next. So, a stimuli that had been there before can cue a backward association 'over time' by the overlapping parts like this going back to the original experience and its interconnected holistic features. This would be the declarative or conscious memory of the whole experience.

The holistic, multisensory interconnection may not have happened properly in the Korsakow patients in the first place. That is why they could not, by the **cue** of a recurring picture, **re-collect** its multisensory circumstances or representations in the mind, the (conscious) memory of the experience. I realized here that 'conscious' may be related to experiencing contrasting inputs in their connection. This will be of importance in the last passage of this article which describes concept formation (memory construction).

The memory of the Korsakow patients was limited to one modality. They displayed **visual recognition memory**, or visual implicit memory, about the recurring target. The target raised a feeling of familiarity in the patients, indicating that some kind of memory was there. Visual recognition can be accounted for by a combination of the following physiological mechanisms (These mechanisms also work in other sensory modalities, and in part in motorics.):

- retinotopy
- lateral inhibition
- LTP
- repetition/duration of stimuli

As already mentioned, I had learned about the theory of concept formation. Another topic I had encountered in my studies was the perception of facial beauty. When standardized pictures of different faces are piled up, an average face pattern called 'composite' appears⁵. Francis Galton was an early researcher of this who literally piled up semi-transparent standardized pictures. Today this is done by use of the computer, averaging the lightness of pixels. So, the composite is one face coming up by conglomerating different faces. Normally, it might make sense to assume that the averaged beauty ratings of the individual faces would equal the beauty rating of the composite. Yet, it turns out that the composite usually is rated higher in beauty than the averaged sum of the ratings for the faces making it. The finding of higher perceived beauty of the composite is explained by 'process facilitation'. It is said that this average face (not to be confused with the notion of 'average beauty') tends towards a prototype of 'face' and therefore is processed easier, because it is a **very typical** example of the category,

or concept, of 'face'. The enhanced easiness of processing coming by the composite would result in more delight on a subjective level, accounting for the higher beauty rating. The composite would go towards a prototype as the most *familiar* exemplar of the category or concept ('face'). The explanations to date did not take into account much of true physiology of the visual system.

When we encounter a specific visual pattern in the moment (rather time phase) it will be processed *retinotopically* in the layers of the visual pathway towards the cortex. 'Retinotopical' means that the arrangement of neurons largely remains the same over neuronal layers, from sensors up to cortical areas. Thus, the relations of edges or contrasts making the specific pattern also remain the same on successive neuronal levels. Lateral inhibition is the mechanism that makes synapses at visual edges fire more than others. Thus, a specific **configuration** of neurons according the input pattern will experience relatively more **LTP** for the duration of the input. LTP names the mechanism that makes used synapses easier to fire again simply by their usage. Like this, a composite of the pattern is inscribed in the visual pathway by the experience of it. LTP primes a specific configuration of synapses according the pattern. That's how the same pattern is processed easier in the second presentation as it tends to speak again to the before used and so primed synapses. May be this will come with a feeling of familiarity. Most likely a brain stem mechanism (also) is involved here. By the mechanisms of duration (piling), retinotopy, lateral inhibition, pattern specificity and LTP, a composite according the specific visual target is inscribed in the neuronal tissue of the visual pathway, and then later the same pattern tends to speak again to the before used, and so accordingly primed configuration of synapses.

Healthy persons must be understood to have this implicit memory capacity in each modality, plus the capacity to interconnect these with each other. The capacity to **interconnect crossmodally** is lacking in the patients. It mediates the holistic, declarative, conscious memory of the experience (including the 'day', a representation as part of the momentary processings, made up itself by representations of former experiences, the concept of 'day') rather than just the separate, implicit, functional memory for the visual target.

By these explanations a physio-logical frame to understand memory processes appears. The general model consists in the separated pathways (sensory and motor) on the one hand, to mediate implicit memory by pattern-specific training (LTP). Notably, such a unimodal pattern is graded and complex in itself, with pattern-specific characteristics. On the other hand, there are crossmodal interconnections of the separate pathways, and according (specific) crossmodal activation patterns, in the brain, making for the added capacity to recollect multisensory features of a former experience, which as a whole then makes explicit, or **conscious**, memory of the specific experience.

Complexity of the model arises by the huge amount of moments, of inputs, by the high number of neurons, and with it possible activations and non-activations, by the degree of neuronal differentiation and possible interconnections (vs. non-activations in a given moment). Complexity is also coming by the reality of the brain as a much more complex system, with feedback-loops and evolved structures beyond the general **model**.

Explicit memory establishment happens in every given moment. A specific visual pattern, a visual scene, may be associated with a paralleling sound atmosphere: for example the scene of a landscape (combined visual patterns of trees, fields, animals...) and the *sounds* present in **that scene** (combined acoustic patterns of rustling leaves, a bird singing, wind, etc. ...) plus other sensory inputs. As they occur together, the according complex but unique activation patterns of both modalities are interconnected as a complex cortical activation pattern (vs. non-activations). Later, a recurring piece of the experience will tend to go along the before used sensory pathway and along the before used cross-modal brain connection to elicit before paired activations of the same and other modalities in the sensory cortices, without their according presence from outside. They will then come up as 'secondary' perceptions, a picture of the scene, or as a sound *in the mind*. It is a thought, a concept, a memory ... a re-activation, a representation of the experience in the mind. The thought resembles the real perception from the experience, and uses the same cortical connections. But it might just be more vague and fleeting than the real experience, as it is not actually present from the outside but just cued by a before paired input.

Thoughts, concepts, ideas, memories are akin in nature in that they are re-activations, or representations of before activated perceptive patterns in the Neocortex ('including' non-activations)^{6,7}. In the case of speaking to oneself in the mind, a common way of thought or memory, slight premotor and auditory cortical (re-)activations mediate such thoughts^{7,8}. In the beginning of life, instead of **goal-adjusted action**, there are rather chaotic reflexes fed mainly by somatic⁹, but also by other sensory inputs. Body satisfactions paralleling 1) cognition and 2) movement should backfeed on these to imprint 'useful' behaviours for the future⁹⁻¹⁶.

The basic principles explaining implicit visual memory, as presented above, recur in other sensory modalities - sound and somatoception - and partly in the motor pathways. Differentiated neurons in the human neuronal system share activation properties to facilitate association of their differentiated functions. They interact for the whole human organism. Cortical cell assemblies – crossmodal - mediate our perceptions, later representations or thoughts. These cell assemblies are groups of associated neurons created by co-occurring activation in them and specific non-activations, according a given input situation. After the establishment of specific crossmodal connections, activity in a part of the assembly is enough to ignite more of the **former pattern**^{7,16}: association, thought, memory.

It is said that perceptive parameters of a sensory pattern (like contrasts in vision) are processed in specified functional columns in the neocortex. **Crossmodal cortical** patterns are facilitated by pyramidal cells that can have long axons. They should work to combine distant neuronal activations, of differentiated function.

The establishment of crossmodal cortical associations depends on **subcortical** mechanisms in the first place (more about this in the following passages). But once they are established, cortical associations can act more independently of the emotional centres.

By these considerations, our current knowledge of neuronal physiology and activity from modern research underpins the former insights of introspective research, about the nature of thought,

associations, memory. As we are seeing the world through our human eyes, introspection must be part of every science. Those eyes are connected to a history and it must be assumed that it is rather difficult to completely turn it off. In Psychology the subject and object of research become equal. That is why the positive to negative contribution of introspection is bigger here than in any other science. Therefore, our best bet is to look at a theme from all available viewpoints and use all available methods. The zeitgeist of modern psychology, fed by the development of computers and by the wish to approach nature scientific precision, has brought major insights about the basic processes of neuronal functioning. But it has also shut out less precise research levels in the social domain, and limited integration and a global understanding of the natural aim of our neuronal functions. Also astonishing during my literature research I found the wealth of animal studies (especially rats) while a lack of naming from them directions for the understanding of human development and behaviour.

Questions

The presented insight to here raised questions in me. I went on a reflective and introspective heuristic path. Three main questions occupied me, and they lead to one answer.

Thinking of the nature of associations, I started to wonder: How can I be free if my thoughts are made of mechanistic associations? If I simply associate inputs according to their occurrence and repeat them according to recurrences of their parts? Logic told me I could not be free. Looking up from the books I searched experiences of freedom in my life. I found love. From my personal experience, feelings of freedom accompanied feelings of love. So I said freedom must be coming from love, from emotion.

Another question: If all stimuli are integrated in the moment, the more aware ones with the less aware ones, how is their relative weighting organized? How does attention work? Psychological theories and findings, as well as intuition, suggest that we attend things because they are somehow meaningful, or 'emotionally relevant' for us. Some parts of a current situation have more importance for us than others. Yet, all of them parts have some value of importance above zero for the individual, as they all have to do with our personal life. So I realized we must be in emotion to a degree, ongoingly in every moment. We rather call the peaks and vales of our experience emotion. But we are in emotion all of the time, about our surroundings, about our life. But what's emotion and where does it come from? How do we learn to attend things? How do we learn to care? I thought we should learn what's more relevant and what's less relevant by our experiences, by the guidance and rewards of our significant others, thus: by love. But what's love? Genuinely? Closeness ... body contact!

Another question: Looking at the ever flowing diversity of sensory inputs and thoughts ... how is relative **consistency made** in the mind? What holds successive moments together within us? How do we feel whole and how are we able to carry a relatively consistent thread of time, a thread of memory? Looking at the ongoing change of diverse inputs, but also the ongoing change of their relative weights (attention), the idea of waves came up to me. Emotions, 'values', weighting our perceptions and cognitions, I figured do feel wavy, too. Emotions come and go to a degree and seem to be slower and more steady than thoughts and perceptions. Subjectively I felt there was also a general slow and deep

swing or emotion within me ... a basic mood moving me through life and giving me a sense of relative stability. Going on from the wave of emotion, the idea of an ocean came up to me: a relatively deep and slow swing for relative stability, more fluctuating moods going upwards, to jumpy little waves of perceptions and thoughts on top. To me, the ocean was a useful metaphor to learn of emotion to be the integral and foundation of the ever moving human soul.

Emotion, the body, love

Because of the complexity of the term, a rough working definition of emotion will be used here: Emotions include subjective states (such as moods, feelings, emotions, affections, drives, motivations) of more or less well-being. Presumably, biological needs have evolved to be translated in physiological substances and processes that mediate these subjective feelings. A subjective state that is perceived as less than comfortable by the individual should normally be linked to expressions and actions to reach betterment. The experience of a positive state following a motor expression (including vocal ones) should lead to its repetition in the future. Appropriate input should balance physiological parameters to mediate subjective comfort, satisfaction, positive feeling, as an evolutionary mechanism. Basic needs of the body (and soul) that motivate action and expression are

- safety/ integrity/ calm
- nutrition/drink
- contact/ touch/ feedback/ attention/connectedness/support
- affection/tenderness/mindfulness/sensitivity/empathy
- exploration/play/ stimulation/ growth/(healthy) excitement/diversion

Environments can offer inputs to more or less facilitate the fundamental body needs. The amount and qualities of inputs in a certain environment determine their nurturing or challenging character for the individual, and accordingly support differentiated behavioural strategies^{11,15}.

Love is an evolved positive drive, emotion, feeling in the individual. It motivates action to fulfill basic needs of oneself, and others (of the own body and of other bodies). Love is also the subjective state coming up by such satisfactions in the receiving individual. Physiologically, specific substances and processes have evolved that mediate the subjectively positive experience of love. Findings suggest that the evolution of love parallels cognitive growth and higher conscience^{11,15,17-20}. Fredrickson delivers a review of emotion approaches putting his finger on the central role of positive emotion in human biology¹⁵.

The priority of touch in concept formation

“The skin in common with the nervous system arises from the outermost of the three embryonic cell layers, the ectoderm. The **ectoderm** constitutes the general surface covering of the embryonic body. The ectoderm also gives rise to hair, teeth, and the sense organs of smell, taste, hearing, vision and touch – everything involved with what goes on outside the organism. The central nervous system... develops as

the intumed portion of the general surface of the embryonic body... . The nervous system is, then, a buried part of the skin, or alternatively the skin may be regarded as an exposed portion of the nervous system.” (Montagu²¹, 1978, p. 2)

The priority of touch

Important **dimensions** of somatoception are: ontogeny, phylogeny, quality, quantity, growth/health/physiology, intimacy/safety/trust, reward, culture, subjective/objective. The dimensions put up a complex reality space²²⁻³⁰ of which only a sample according the author's estimation is taken into account here to indicate some important research and therapy directions.

Primates display extended contacting behaviours beyond reproductive or hygienic ends. Reciprocal body care is given by sweeping and picking movements, hugs and extended body contact: ‘hanging out’ together. It's called grooming, or allo-grooming¹⁷. The ability of extended grooming and hugging depends on anatomical adaptations: (long) arms and manipulative hands. Grooming stimulations are an energetic input to the body letting the individual feel the presence of a fellow. Individuals with tendencies to stay close together like this have better chances to fight predators, up to diminishing attempts of attacks in the first place. By staying close and so appearing in a group, safety is increased for the individuals. This should have worked to free resources formerly needed for fight or flight. Grooming is found in pair-bonding³¹, friend-bonding¹⁷ and parenting^{32,33}. All of these interact in a group system to mediate the primate life-cycle^{17,31,32,34-38}. The development of grooming parallels a relative growth of the neocortex¹⁹, the site of cognition, and also a growth of the amount of EEG-alpha-wave²⁰, a physiological index of relaxation and associative wideness. Reciprocal grooming facilitates a new level of **cooperation** and connectedness in evolution¹⁷. Exchange of body care and extended closeness are the origin of friendship and social support^{11,12,17,24, 31,39-41}.

Reproduction in primates is made by more than closeness. It has evolved to happen by one body penetrating another. This **procreative style** depends to a degree on cooperation, on trust that the other won't do the body (and soul) harm when close^{Morris}. Then, the human 'egg' starts to grow within the body of the female. It's a plus in **safety** for the breed. However, it also heightens the **investments** of the mother carrying the baby. It must have evolved in the frame of cooperative, secure group life^{26,27,28}.

While all the senses start to be active already in the **womb, somatoception** has a priority role from the beginning, mediating adaptation and movement within the given space³⁶. In Japan, pregnant women receive shiatsu massage by their partner, and the men also start communicating with the baby when it's still in the womb. This is supportive of the woman's well-being^{28,37,38}, the child's development^{37,39} and stability in the family^{27,29,39}.

Shortly after birth, somatosensory cortex exhibits significant activity ahead of other sensory areas. It reflects the fact that the human baby is a parent clinger. Also strong already are the hippocampal region, cingulate cortex, thalamus, motor area⁹. This indicates a **fundamental role of somatoception** for the upcoming psychic functions. It must be the main 'energetic' channel, so to say. **Body contact** is

mandatory for **survival** of the human¹⁸. It is the well of organic to psychic growth: of sensory, motor, cognitive and emotional processes^{18, 40-45}. Body contact is as important as nutrition for survival^{18,47}. The research to this point is insightful and indicates to abstain from repeating severe deprivation research. Close and tender contact and stimulation from birth on, and before, procure lasting health and well-being.^{42,46,48-50}.

By definition, neurons of **somatoception** are found all over the body. The skin is our biggest organ. The skin and nervous system come up from the same, the outer embryonic layer which also brings up the classic senses¹⁷. (Thus, the classic senses can be interpreted just as specifications of somatoception, as all senses work for the life of the soma.) Sensors of somatoception are found in the skin, visceral organs, muscles and joints. The fascial system is of importance^{51,52}. Somatic stimulations can impact mechanoreceptors, as well as thermoreceptors, chemical receptors and pain receptors. The sense of balance transmits information about the location of the body in space, proprioception lets us feel the heaviness, location and movement of our 'material', of the body parts. The somatic sense enables us to be contacting other materials too, from exploring objects to being hugged by someone. Somatic input is the major source of **relating**^{29,42-44,53} and of **conceptual understanding**^{9,20,41,54-56}. Both functions are interrelated^{14,29,43,54,57}. Somatoception allows us to grasp things, literally, as Piaget had discovered^{20,55}. Somatoception facilitates - space and other sensory - concept formation^{14,56} also by enhancing movement (exploring a territory, grasping: tactile exploration)^{18,54,58,59}. Taking all the somatic facilities together, the body sense should contribute to a feeling of real existence, of understanding, of being there in the world like no other sensory modality. **tanzreferenz**

All types of non-noxious somatic inputs seem to nurture the body and nervous system. Such inputs are for example touch, warmth and food (don't skip family, or romantic dinner!). These stimuli launch processes of recovery, growth and social bonding, they enhance metabolism and create cardio-vascular strength, by vagal nervous activation^{11, 60-67}. Kersin Uvnäs-Moberg called this pathway the calm-and-connection system. (Potentially) Damaging body stimuli - strong pressure, cuts, etc. - are processed in a separate pathway. Such noxious stimuli evoke an opposite effect pattern: They cause arousal and mediate action, bodily resources are retrieved/needed^{15,68}. This is usually referred to as the fight-or-flight response. The two pathways could also be called the **care system and the demand system**, respectively. They mediate two distinct life styles^{68,69} according to a (real or perceived) environmental situation (demanding vs. supporting). There may be a third strategy, to deal with (perceived or real) lack of options and stimulations: a physiological pattern to reduce activity and limit resource usage, a deprivation /depression/waiting pattern⁷⁰.

For the existence of the evolved **care-physiology**, neutral-positive body stimulations cause various natural medications in the body^{45,59,60,71,72}. The neuro-substance **oxytocin** is a powerful agent in this system of positive effects^{11,65}. It appears first in mammals, animals with extended skin contact by definition. Oxytocin comes up by various stimulations of the skin and body during sexual and neutral-positive contacts. It can come by active and passive touch⁸⁸ of the hands, mouth and body.

Oxytocin is caused for example by animate stimulation of the stomach^{62,71} and **trunk**^{24,46,59}, as in hugging, stroking, massaging or lifting a child. Deep touch stimulations of the stomach have been proven fundamental for well-being, health and growth^{18,24,42,63}. Stomach-to-stomach contact, as in hugging, carrying, breastfeeding, holding a child, or during sex, seems to be the pivot of the life-long bonding cycle. Variability, a **characteristic** of loving and playful bonding interactions (i. e. suckling, kissing, stroking) is important for touch to have positive effects^{24,46,62,63,71}. Accordingly, mechanoreceptors exhibit the highest firing rates when input intensity changes. **Moderate**³⁸, **warm**^{60,61,72} **soft**^{43,46,72,73}, **slow**⁷⁴ and deep touch stimulations^{24,56,63,71}, respectively combined with variability, have **positive** effects. These characteristics signal consideration, attention, care, 'tender feelings' and flexibility of an animate relator. Benefits of touching interactions include all involved^{26,29,31,39,72, 76,77} in the free frame (read more about freedom, autonomy and intimacy below).

Tenderness is a central parameter of healthy bonding ways^{43,46,72}. It translates affection^{73,74} and adjusted care. The human skin itself is tender.. it's soft, to hairy, and warm. Some body parts have a in-depth-softness, like the female breast, the cheeks, the mouth and the stomach. Sensitive interactions on the pair level interact with parenting style^{27,29,39,71,78}. Soft touch is processed in the limbic^{46,73,74} to frontal brain. The right limbic brain mediates bonding relationships in the lifespan and prosecutes main growth spurt in the first one-and-a-half years and is dominant till three years⁷⁹ It's the time phase where tender care has strong impact on development of the limbic structure and functions^{43,79,80}. **Tenderness** in early life is the pivot to establishing immune reability and cognitive sprouting towards life^{46,56,79,80}, but should also be impactful later^{11,59,60,61}. Tender interactions cause oxytocin release (i. e. suckling/breast feeding, kissing, stroking) and are most likely affecting amygdala connectivity^x. Immune function by closeness and tenderness appears as the center piece of the developing inner working model, weaving together psychic to organic health parameters^{11,23,58,59,81}. Tenderness and contact are central for the human condition in life^{44,50,82-84}.

The human baby is a parent clinger and also exhibits evolutionary expressions to achieve care (clinging to following, crying, smiling). While mirroring the child's expressions by mimics, gestures and sounds is important stimulation to mirror it its existence^{47,79}, the only way to substantiate care is by touch and body contact^{18,24,39,40,41}. Only contacting and adjusted **body care** will energize existence^{18,39,41,80}, channel perception^{14,39,41,81}, motorics^{14,39,43,58,81}, health and well-being in the child^{42,43}. Notably, the human is the only rather naked ape^{Morris}. The condition of being so over the whole life span must have come with cognitive ability (of using shelter), and by cooperation/grooming. Nakedness itself allows easier transmission of warmth and tenderness in bonding relations.

Ainsworth and colleagues observed [body] interaction patterns of attachment styles. Secure attachment is created by vast amounts of contact (to availability), contiguity of signals to care, support of autonomy, and tenderness - sensitivity, tact, affection, focussed care ... consideration, attention. Four **parameters** of contiguity^{2,43,79} (of need expressions to satisfactions) of **secure caregiving** have been identified⁴³: perceiving a caree's attachment signal, interpreting it the right way, responding to it promptly, and adequately. Insecure attachment styles develop when these criteria are not met⁴³.

The **inner working model** of attachment specifies the emotional, cognitive and behavioral tendencies a child develops during the interaction with caregivers. The ways of the relational experiences shape brain connections and **physiological** parameters^{46,92-96}, inscribing strategies of how the individual will tend to interact with the world and people in life.

The **concept of inner working model** was brought to the table first by John Bowlby. His major progression from the Freudian approach was the realization of the importance of current relational parameters. His concept formation process about the nature of the parent-child relation arose from the observation of psychopathology and separation. Bowlby saw the baby's need to cling (as Harlow had observed in monkeys¹⁸) and to be smiled at to be as important as food intake⁴⁷. Attachment researchers of the time realized the evolutionary origin of safety by closeness. They also learned that the attachment tie continues, even over phases of separation or if there is no genuine attachment behaviour enacted all the time^{43,47}.

Bonding style is more dependent on experiential input than on genes^{42,44,45,56}. **Bonding** experiences of the caregivers feed back to their genes to shape their **behaviour** towards the child^{49,56,86,88}. Secure bonding is procured by a person delivering ongoing availability, **closeness**, safety and body contact. These all are mediated in the beginning of life by carrying. **Carrying, holding and lifting**, supports the development of the care physiology^{42,43,48,89}, the manifestation of the secure attachment style in the body. Tender contact of **stroking, breastfeeding and kissing the child should work for it especially**^{43,46,81}. Secure attachment is the healthy tendency of the developing inner working model^{11,41,,43,46,59,76,77,89,90,91}. Carrying and closeness with skin-to-skin contact, called Kangaroo care, is especially supporting psychic functions and development^{39,41,48,72,89}. Closeness enhances reactivity, talk and reciprocal interaction from birth on^{18,39,48,63}. Knowing of the fundamental impact of skin-contact to energize development, it doesn't seem extremely far fetched to hear stories of seemingly dead newborns coming alive by close skin contact with the mother or sibling^{38,39}. "To touch is to give life." (Michelangelo). **Close contact** directly after birth, and then going on during the first three years has powerful effects^{42,43,48,50,79}, but also later.

Insecure bonding styles develop through deprivation or maladjusted touch experiences (harsh, interfering, painful, injuring)^{43,44,82}. Insecure bonding style displays heightened cortisol levels, reduced stress coping capacity and cardio-vascular deficits in life^{82,90,94}. Inadequate touch experiences are related to developing depression, aggression and other psychic to organic disease^{46,49,53,65,82,95,97,98}. Restorative potential is highly indicated by the healing effects of various body oriented interventions^{24,31,77,84,99}. In early life, not only mothers have high influence over these processes, but also fathers' partaking is an important column for the child's well-being^{27,29,39,57,72} and the family.

The chronology of brain development indicates a priority relation of somatic input for motor activity⁹. Body contacts have a major role in the motivational system¹², for **motor** processes^{39,58,66}, to trigger explorative¹⁸ and social movement¹³. Accordingly, attachment research has revealed that the satisfaction of basic bonding [body] needs will enhance **exploration**⁵⁴, thus, 'developing' activity in the individual^{18,24,43,100,101}. Attachment contacts mediating basic body needs will work to deliver and release energies^{26,102} that can feed movement, play, 'adventure'^{43,100,101}. Neoteny is the tendency to use

developmental stages for adaptation. Humans tend to have preserved creative and playful drives over the life span (along with bonding/naked skin contacts). The creativity should give **adaptability** over changing environmental demands. Neutral-positive to tender body contacts enhance positive feelings in the human and physiologically work to broaden thought and action perspectives^{15,23,68} and repertoires.

A secure bonder will support upcoming autonomous drives (in early life for example during feeding^{43,72}) to enhance development of the caree/partner towards life and the world^{100,101}. Bonding partners display rhythmic interactions of signaling and reacting⁷⁹. Secure bonding interactions have been shown to be 'loosely coupled'¹⁰³, allowing for explorative free spaces and play. Bonding brains swing together^{79,108}. Exploration and play in the secure **bonding frame** should enhance cognitive development (concept formation) and abilities of the caree^{43,49,57}. It's a interplay of predictability/reliability – the safe haven of attachment - and exploration. Enhancing learning experiences and enabling a rich environment is part of a secure bonders repertoire^{29,43,57}. **Exploration** seems to be a basic human need itself as indicated by children crying when told to stop running around or playing, or by adults experiencing 'bore-out' by overboarding routines. New experiences can enhance feelings of lust and are accompanied by dopamine-release. Newness of mild stress value (and short duration) enhances cognitive development¹⁰⁴.

The human physiology allows for two main behavioural styles: In the demanding frame, mostly any behaviour mediating survival will be enacted. In the **safe** frame, the tendency for recovery to explorative playful behaviour is pervasive. Primates' ability of extended cooperation would have enabled this, by adding and freeing physiological resources^{11,26,99,102}. The characteristic of explorative freedom in secure attachment frames enhancing cognitive development, should have established because of it's adaptive value for survival^{33,34,54,56,100}. The difference to other animals seems to lie in an extended frame of support relatively far around immediate satisfactions (i. e. food or sex). Yet, as mentioned earlier, general closeness brings enhanced safety, freed resources, well-being and positive feelings of friendship for the involved already^{26,35,77,102}. An unconditional basic income is an equivalent of secure attachment frame for adults as it secures food, shelter/safety, autonomy. Such facility has been the basis of the biggest inventions, discoveries and art pieces (i.e. the light bulb by Thomas Edison, the insights of Charles Darwin, Vincent van Gogh, ...).

By freedom, it is not meant independency of others here. Human freedom seems to come up by healthy attachment, by a middle degree of inter-dependancy, by reciprocity, by balanced free interaction. Fulfillment of basic body and bonding needs furthers well-being, health and exploration. 'Securely attached' individuals tend to peaceful, cooperative, explorative behavior supporting their own development, their relationships and **groups**^{26,29,54,57,71,100,101}. Like this, attachment theory specifies how interaction quality can mediate development and the fulfillment of tasks and goals in different social **settings**. The model is a triangle made of the attachment relation and the task/developmental goal (exploration). Aiming to apply or translate the characteristics of secure attachment (read above) in the relation can support health care, child care, personal relationships, pedagogic situations, leadership, processes in the workplace and societal development.

Via the thalamus, it is inputs from skin stimulation and the sense of balance that rule cortical weighting and association, over all other sensual inputs. They selectively activate areas of the cortex while shutting other areas out^{14,105}. So, genuine body inputs are the priority feed to attention. Somatic inputs bring order to all inputs that would otherwise be overwhelming for the individual²⁴. Somatic inputs may work for attention in two ways: in a direct³⁵, and in a more general, relatively lasting manner¹⁰⁶. (Somatic) Thalamic involvement is necessary to establish associations (episodic memory). Once established, associations can be active solely via the cortex (semantic memory, conceptual knowledge abstracted/freed from personal history)¹⁴⁷. Somatic effects reign processes of memory construction, concept development, cognition and behavior - more or less consciously^{20,35,43,46,56,84,106}. Part of somatic thalamic inputs are acting relatively slowly, and they act independently of the neocortex¹⁴ thus mirroring the priority of genuine body signals (survival to reproduction) over everything else. Because nothing can have more immediate relevance than physical contacts to the body. Things that we hear or see may still be relatively far away. Only touch is proximal.

The role of the sense of balance for cognition and well-being may be reflected in the positive effects of rocking a child, of movement games in childhood, of swing, trampoline, seesaw, of sports, and of rhythmic movement in different settings. The basic property of living systems of movement, change, variability, comes into play here (again). Activation of balance sensors may enhance feelings of the self, and bring flexibility to cognitive processing therefore carrying therapeutic potential¹⁰⁷ besides its role in development. Movement games are an integral of child rearing and enhance covarative learning (read below). Bonding interactions are loosely coupled, "almost like a dance"¹⁰⁷. Bonding brains tend to swing together^{79,109}. Moving together supports social connection¹⁰⁸, possibly by activating mirror neurons, and to support the experience of being seen (smiling reaction is a movement [reaction], lifting is a together-movement, expression to satisfaction in bonding is covarying movement, too^{63,79,107}). Relative rhythm (or reaction) delivers an amount of predictability. Moving together during contact is central in bonding relations: for example during sex, and other interactions^{42,63 79,110} inhering high reward property⁶³.

Along with grooming and oxytocin, primates display a relative growth of the **neocortex**³³, the structure mediating representations, thought, 'intelligence', cognition. Neutral-positive body stimuli of relative intensity - non-noxious pressure and contact to body parts - are led to the somatosensory cortex^{25,73}. See also the table of the somatosensory homunculus indicating the representation of body parts in the postcentral gyrus. This pathway could work to feed cortical expansion in ontogeny and phylogeny by vast grooming and brood care contacts - for example by ongoing amounts of carrying, hugging or hanging out together: Somatic stimulations enhance cerebral blood flow^{41,99}, they most likely enhance brain connectivity^{11,111} and should facilitate (positive) memory^{56,111,116}. Positive body stimulations cause oxytocin^{11,59,62,71,76} to spread into the cerebrospinal liquid, enabling a global impact on the brain^{12,112} including other transmitter systems, for example dopamine¹². Oxytocin supports learning¹¹¹ and positive feelings/well-being^{11,65,113}, and it is easily conditioned. This latter fact facilitates effects of the care physiology by rather only symbolic interaction (mimics, gestures, speech) in the public context (institutions, work place). Yet, the ability to cooperate and feel comfort by symbolic means only (the health effects of 'supportive' settings) probably depend to a huge degree on regular activation of the physiological care network through genuine bonding contacts in private relationships^{71,111} and by body

methods^{59,106,114}. Oxytocin effects are relatively lasting but depend on regular activation^{71,114}. Oxytocin is not only coming by nurturing contacts, it in turn also enhances contact seeking and prosocial behaviour^{113,117,118,x}, along with enhancing relaxation, lowering fears, and reducing pain. From these insights, and from the importance of touch for growth and development outlined above, it appears why body stimulations bear high therapeutic potential^{24,33,62,65b,67b,67c}.

Interestingly, the first and often last conclusion of positive oxytocin effects is to use it as medication. It shows that our view of healing is somewhat astray from the natural, human, sustainable, pragmatic and effective approach (role of the pharma industry..?).

The idea that the neocortex grew by freed resources is not widely shared. The current view is that a bigger neocortex came up by higher demand of growing social circles and interactions²⁶. Why are social interactions seen as demanding rather than relieving by scientists? The research findings presented here indicate that the bigger part of higher development is facilitated by social support and -relief^{26,41,46,56,99}. Stress can enhance cognitive development if it is not overboarding¹⁰⁴. Deprivation experience in early life is demanding, and it doesn't lead to growth, but the contrary^{18,40,53,80}. Of course, a fight-demand may have enhanced strategic thinking in evolution, but the well of this development should have been vast supportive (in-)group contacts^{18,26,99}.

Another aspect paralleling cortical growth, grooming and cooperation in primates is a rise of the EEG-alpha-rhythm³⁴. The **alpha**-wave is said to 'originate' from the thalamus. Alpha indicates processes of **relaxation**, associative wideness and cognitive diversion. Alpha seems to stand for a state of lightness, well-being, 'nonchalance'^{167d}. Adrian found that a single tactile stimulation generated a series of 10-Hz-alpha-waves in the thalamus going on towards the cortex⁶⁸, towards the somatosensory cortex in the case of neutral-positive somatic stimuli to body parts^{25,58}(table ...). 10 Hz is the same value as the spontaneous basic cortical alpha. The basic cortical alpha is only established in the course of childhood, a stable alpha is detected from the age of three on^x. Alpha could be an indicator of secure attachment and somatic history^{69a,69b}. Because alpha takes over when awake but eyes closed, it had been interpreted as indicating idle state vision. When you close your eyes, you realize that shutting out vision will enhance sensation of the body.

Another important brain wave is given by theta. Theta is the main wave in the EEG of animals, it appears during orienting, self-grooming and movement⁷¹. Theta also is the main wave in small children. This wave is related to processing newness, appears during demanding cognitive tasks, is heightened in soldiers^x, is related to reward and loss calculations, and according weighting of behavioral options⁷³, and is also observed during 'emotional' processing. It seems that theta is related to mediate the integrity of the body (up to the self) during 'adventure' facilitating **concentration during a demand, the direct link from input to output.**

Theta is said to be originated in the hippocampus. Early touch has a main impact on structural growth in the hippocampus, by this on immune function and cognitive thriving^{46,49}. Theta in the hippocampus can be elicited by different sensory stimuli and then habituates, except for tactile theta⁷⁰.indicating a major

role for the psyche over the life span. An immediate relation of touch to hippocampal activity and behavioural output is already suggested by the chronology of brain development³⁶ and by touch effects to transmitters systems^{14d}. behaviour.

Theta is related to declarative memory (crossmodal associations with personal relevance) while alpha mediates semantic memory (crossmodal knowledge of facts detached of personal relevance). Alpha is the basic rhythm in adults. A steady alpha is not observed in children before the age of three (before it's theta that rules). Theta has a obvious relation to touch, alpha probably too, supporting the body approach to cognition. In a study, we modeled a hug-like stimulation. It led to a right-shift of alpha and theta in the brain, during low task demand⁷⁴. Conclusions drawn from this are preliminary by the current status of data. The finding could speak for the relation of touch to the memory-waves alpha and theta, and support the role of stomach stimulation for bonding processes in the brain⁵⁶ (right brain activation⁵⁶). With nonchalance, the finding could speak for the fact that memory processes are only supported by body stimulations when happening in relaxed/secure situations (low load). Interpreting and understanding EEG is still an interesting challenge.

While neutral-positive body contacts of a certain intensity are rather only led to the (centrally located) somatosensory homunculus (read above), stimuli of immediate (behavioural) relevance inducing genuine pleasure, or pain, have priority impact in frontal processing⁵⁸. These frontal traces should serve survival of the body on the one hand, and reproduction of it on the other. Soft and slow touch are perceived as positive, they mediate bonding and immune function. They lead to anterior cingulate activation and orbitofrontal activation. Warmth and tenderness also are projected to the orbitofrontal cortex, namely the insular cortex Craig, Olausson. Watching a photo of a love partner as well affects the insular cortex and the **cingulate cortex**. The insular cortex is discussed to be important for awareness. Regions processing positive and nurturing touch are also important in empathy, a sense of 'corporeal' self 'and' consciousness.^{62,x}.

A powerful dimension of somatoception is **intimacy**, as part of love relations, parenting, and friendship. Even though non-noxious body contacts generally have a positive connotation, they are not happening extendedly or randomly with anyone in most cultures. Morris names 10 steps towards intimacy in a romantic setting. The steps display an approaching pattern, first of the bodies themselves, then going on from more distal to more central, or vulnerable, 'intimate' body parts. The stepwise approaching serves the gathering of information on different levels and parallels the building of trust, the conviction that the other respects our integrity. Freedom, or free will, is a major characteristic of healthy relating. It refers to the autonomy and exploration part of secure attachment.

Deprivation of touch as well as noxious (harsh, high pressure, painful) touch has bad effects on health and well-being, causing aggression⁴², depression^{21,43}, suppressing development⁴⁰ and leading to psychic illness⁴². Deprivation or violence inhibit emotional and neuronal development⁴⁰ in specific ways, affecting sociability⁹⁰. It should be aimed to further specify the relation of behavioural patterns of caregivers, developing attachment styles⁵⁶, other potentially disturbing life events⁷², and pathology⁹¹ in order to optimize therapies.

Today we know that **experience outweighs genes**, gene expression depends on environmental offerings^{46,49,56}.which underlines the potential of therapeutic interventions.EXPLOR: no environment no training. Parents' childhood experiences mould their genes and later translate in their behaviour⁹² to mould the attachment, health and psycho-logic of the child^{39,41,46,73}. Of course, the securing or demanding nature of a current environmental frame has impact on bonding quality too⁷³ because it can limit security. The fact of experiences ruling genes at the same time points to the **restorative**, therapeutic potential by new experience, in the individual and their relators, 'and' in the life span. High restorative potential may be assumed by facts^{47, 67b,67c,74}, and to exploit self-fulfilling prophecy, even if the impact value of inputs is lower than during sensitive phases in childhood^{47,56}. Support of young families should have long lasting positive effects, to prevent problems (and costs) later in school and teenage years, and over life (Doula, massage, immune later).

A study of the development of adopted children in Romania indicated that the first two years are crucial to establish good health for life^{37a}. According to the knowledge presented here, the restorative potential may have been higher. Possibly, parents intuitively perceived the children as 'too old' to give them the vast amount of tender care that children up to two years receive. Augmenting tender care and contact by awareness in older children could further enhance development after deprivation. A pragmatic and effective means for that is the establishment of massage routines in families that tend to hold themselves up. Again: The impact of experiences to genes generally speaks for restoration through healing contacts.

Oxytocin, coming up by various body stimulations such as massage⁸⁸, acupuncture and bonding interactions, has diverse positive and protective interrelated emotional, cognitive and physiological effects. As already mentioned above, it reduces fear and body pains. It enhances relaxation, social interactions and sexual behaviour. Oxytocin interacts with other transmitter systems, creates a positive mood, enhances social learning and positive cognition. It adjusts immune function in the amygdala and mediates social approach, all that is why we must consider vast implementation of neutral-positive body stimulations to be highly effective for psychic and organic cure.

Endogenous care medications including oxytocin come up naturally by many body stimulations such as stroking, hugging, massage, breast-feeding, suckling, food intake, carrying, lifting, spooning, blankets, warmth, food, warm food and drink, cuddling,combing, playful fights, kissing, orgasm, sweeping, caressing, tickling, grooming, acupuncture, holding hands, sex, masturbation, warm water bottle, cuddly fights, foot massage, bathing, showering, putting on lotion, bathing glove, massage glove, towels, soft blankets, pillows and many more, or by conditioning of these to stimuli of other modalities. In free circumstance, both agents will profit from the health effects of nurturing body interactions. For example will the parent also profit from carrying the baby. Oxytocin effects are relatively lasting, yet depend on regular refreshment.

Looking at the important function of cooperation for development, a general atmosphere of warmth and ongoing availability should be the fundament of effective healing. Health care must aim to translate

characteristics of secure bonding: Security, availability, 'warmth', affection, empathy, support of autonomy. These factors are already transmitted by institutional atmosphere 'and' by the ways of care personals, physicians and thereapists. A caring atmosphere will support the body's self medication, an atmosphere of calmness by relaxed interaction, yet attentive personel, deep voice rather than high voice, slow, careful, open, smile... . The knowledge of co-operation for well-being must lead to a attitude of developing friendship with the client, and an embedding of him in a support social network to enhance growth and autonomy.

Psychotherapy itself then is a classical attachment scenario⁷⁸. The client is to explore and learn in the frame of the 'safe haven' given by the therapist. A psychiatric approach translating secure attachment parameters is Soteria⁸⁵. Here, availability but also autonomy are augmented, and the setting is closer to the real world.

Attachment research indicates that body contacts are the origin and natural compound of relational support to mediate growth, learning and healing. Therefore, the conditions of body contacts to support talk therapy must be discussend and researched⁸⁷. Holding the hand of the other, touching the shoulder in a supportive way, or even a hug should support the development and learning of the client. Massage and acupuncture have proven to procure betterment in psychic disorders. Masseurs and physiotherapists could deliver helpful information on how to deal with interpersonal contacts in the caring relation. Genuine contact may enhance the establishment or restoration of a secure bonding template in the client⁸⁷ - along with establishing and restoring the according physiological parameters²⁹: healthy endogene substances, brain connectivity and positive gene modulation. Body contacts are fundamental in child care institutions. The body/attachment approach also indicates as to why pure talk therapy can have little effects. It should be the case when a sufficient degree of positive body conditioning to symbolic means has not happened in the first place. Notably, an influential amount of body care (or disturbance/lack thereof) happens before awareness in the first 2-3 years of life.

Bringing the knowledge about healthy bonding interactions to mind can help different therapies. The close link of body contact to hippocampal growth and activation suggests that addictions develop as a substitute for the natural and healthy drug: neutral-positive body care. This points to the pivotal role of body oriented methods and authentic care relationships to treat addictions, including eating disorders, and to prevent relapse. The lack of loving bonding contacts also must be regarded the major source of depression and aggressive tendencies. Massage and other body methods have been proven impactful here. Tender care and body contact is the main source of immune function, and is related to cardio-vascular health. Thus, lack of positive contacts causes depression and could heighten the risk for cancers. As neutral-positive body stimulations lead to release physiological growth factors, further immune function and reduce pain, they should be implemented vastly in pain, HIV and cancer therapy (and prevention), as well as in rehabilitation (motor, central, sensory). Body stimulations for example by regular massage could also enhance well-being and self-organization in the disabled and the elderly. Generally, society must be informed about the important functions of closeness and given the frame to live it. As bonding closeness mediates various health effects, it makes sense that the existence of one secure bonding person can mediate resilience towards psychic and organic illness in life.

Depending on a client's situation and history, body stimulations can come from more or less related people (close relations, care persons), by technical means, and by self-care. Support can even be given by therapeutic animals. Having a dog will enhance life expectancy. A therapeutic dog can deliver amounts of secure attachment experience: security, consistency, tenderness, contact, unconditional love to support for example people with autism, enhancing their autonomy.

Technical means can support oxytocinergic effects, bringing positive mood and cognitive **widening**. **Fred und broaden** So, body oriented methods should enhance the ability to retrieve positive memories, explore solutions, and/or to catch and integrate positive new experience. Oxytocin lowers fears, enhances social approach and supports social learning. Most of all, the client should be encouraged to a positive self-view and to the wide range of self care possibilities. Well-being and cognitive relaxation can be enhanced by regular use of a warm water bottle, heavy blankets, heating blankets, the hug machine, a warm bath, good food, by foot massage, combing, self massage, by certain kinds of sound or music as well, and many more. Movement is another somatic method, inhering somatic feedback and activating the cognitively impactful balance sensors. Movement has been proven to have anti-depressive effects and surely to support cardio-vascular health. Self-stimulations as foot massage or stomach massage on a regular basis should work to increase well-being and health, and should stabilize the individual.

Caring relationships are given more or less by ongoing shells of safe haven-ing in society. The shells of security include the relationship quality and life balance of caregivers, institutional atmosphere in health care and working places, general values, the political and economic system. If these shells are lacking or weak, environmental stress will enhance unfavourable rearing behaviours and life styles, according health problems and health care costs.

Our current economic system clearly counteracts basic needs of attachment. A supportive environment is widely not given in most societies. Safety, nutrition, relaxation, support, autonomy, free time, exploration are diminished for the majority of people. The economy is dysfunctional in a sense that it much overprovides for but a small minority of people, for the cost of the majority. Poverty, stress and according health risks are growing. This may explain a rise of developmental disorders like autism or ADS in modern society up to rising suicide rates in economically shaken countries, and of course of stress related illnesses (i. e. cardio-vascular diseases **Henry**, depression, burnout, addictions). Money is not distributed in a functional or fair manner any longer if it ever was. Fear and aggression rise too with insecurity and stress. The problems are hardly solved top-down and may just burn money on this path of bureaucracy supporting corruption. Earth climate changes by destructive economic processes, diminishing a safe and healthy living space. Ruling forces are refusing to calculate future costs.

Attachment theory predicts that the implementation of an unconditional basic income – a bottom-up measure enabled by the current reality of abundance in the world - would serve to secure the individual, so to frame adult 'attachment security', embedding the individual in a societal safety net that delivers for basic needs. According to attachment and basic income research, giving this basic security furthers health, happiness and productivity, apart from it's necessity because of rising automation, poverty and

nature destruction. Against the lay view that people would stop working if they were basically secure, attachment research implies that the majority of people would rather experience energetic flux by such security, for their chosen field of productivity. Basic income pilots have according outcomes. Meanwhile, a shift of growth indicators is in demand anyway. Looking at the current economical imbalances it is all too obvious that growth indicators somehow must represent human well-being and satisfaction, rather than monetary profits (for a few) that fail to be distributed properly today. Hoarding is the attitude that lost its sense by the current abundance of goods. The old concept of hoarding dries out the whole economy. This old attitude drains the many, the planet, our living space, thus diminishing security of our all future.

The soothing to rewarding character of non-noxious body contacts and satisfactions in a safe frame - along with wide ranging health and cognitive effects - suits reproductive theories: closeness is our motor. It's our motivation, haven, and goal in life. Whether we make ourselves a sandwich, meet friends, or do science, sooner or later our motivation to survive and strive may come by the wish for positive body contacts with some other human. First we receive the love and closeness of our parents, later we seek soothing and rewarding closeness with a love partner. The motivation of positive closeness moves us through life, even if we are not conscious of it all the time. Even those who are less fortunate in their current experiences should carry the knowledge of salvation by closeness in some of their genes, to be reactivated^{67c}: Survival has been made by those who love on. This inner truth sometimes just takes (re-)activation by a certain amount of restorative interactions. Close relationships are the well of happiness and well-being no matter if you're rich or **poor**⁹³. Neutral-positive body contacts are the origin of cooperation, growth and peace^{27,62}.

Concept formation

Imagine a creature that has only one sensory ability: to see white light. It only can perceive white, that's all.

What level of consciousness would this creature have? Think about it for a second.

Now, please imagine the creature could perceive two qualities: red and white. What level of consciousness has the creature now? Compared to the first situation? Now the creature has the ability to perceive two qualities next to each other. It is given a first possibility to compare: white against red. It's a first elementary contrast. By the experience of **white versus red**, we may assume a higher degree of consciousness here.

Now imagine the creature could not only perceive white and red, but diverse other visual qualities. Like this, the number of possible contrasts between them would be quickly growing. What if the being also had other modalities? These could inhere graded and complex 'contrast' patterns in themselves. What if cross-modal association of these was made?

Elementary contrast is the basis of more **complex unimodal, and then crossmodal contrast patterns**. **Conceptual** consciousness comes up by specific combinations of elementary contrasts, intra and intermodally. Elementary contrast is the element of concept formation, or, (representational) memory, or, cognition.

But like this, we only had a multitude of (possible) interconnections. How do we get the sense in it? How do we prioritise? How do we filter or attend? And where does a sense of stability, or the subjective golden thread of experience come from? Aspects of our constitution, namely the **attachment system, and parameters of experience** may combine to manage ongoing complex experience and cognition.

A main principle of association is given **by covariation**. This concerns parameters of experience, more specifically of stimulus occurrence or -presentation. Concepts or objects will be imprinted or represented in the neuronal system in the way their sensory elements occur, change, or move together. It's a rather fundamental and perceptive idea of covariation (though of course this is at the same time the very basis of more abstract [social¹⁷ etc.] impression formation). Laws of association by Aristotle or Brown are in line with the principle of covariation together with the introduced idea of (relative) elementary contrast. The strength of association is made by closeness in time or space, similarity 'and' contrast, the intensity of a stimulus, the amount of repeated co-occurrences of two or more stimuli, the passing of time, as well as competing occurrences and associations. Gestalt laws may contribute to understand association by covariation.

The constitutional factors to mediate concept organization have been described in the paragraph 'Priority of the body'. So we know that cortical activations are gated by somatic thalamus input, of the skin and sense of balance¹⁷. Carrying, dandling and **rhythmical games** are common interactions between the baby and a caregiver. The cradle has long been a basic of child care. Movement games mediate experience of covariation to form concepts and enhance cognitive channelling^{65b,53}. Touch and movement will positively condition and weight the association of crossmodal item characteristics to form a concept. Touch enhances cerebral blood flow, neuronal growth and brain connectivity. Later, active touch has an important role in concept formation^{17,20,48b,53} when objects are explored with the hands and mouth. Grabbing objects will again mediate covariation (what parts of experience are moving together versus a relatively stable background) to learn what aspects of experience belong together, and added the tactile characteristics, to form a concept, an inner representation by crossmodal association of all the senses.

Imagine you carry a baby. You are holding it safely in your arms or lifting it with both hands holding the stomach. Then there is some red item, say a **red ball**. You could hold and lift the kid rhythmically towards the ball and say in the same rhythm repeatedly "Red". Because these sensory qualities (visual, auditory, bodily) have the same rhythm, or, 'move together', they are weighted, and associated together. They covary. A variable stomach stimulation with the rhythm of lifting and speech should support crossmodal association of these experiential perceptive elements, and at the same time enhance feelings of liveliness. Instinctual baby talk simplifies experiential structures. Like this, very basic or raw concepts start to be established as the basis for later developing more refined concepts. Funny contents appear when children start to make deductions. It is not that they are stupid, just that their experiences

are not full yet. Like this example with the red ball, concept learning happens on a daily basis in the frame of securing and rewarding closeness.

'Fly **amantia**' is red, too, but also white, and it is poisonous. And it is found in the woods. What 'poisonous' means, a kid will learn by observing processes of death and by experiencing illness themselves accompanied by explanation and guidance of a caregiver. What 'woods' means as well is learned by personal experience.

An example of higher order concept learning is the concept of '**dog**'. The bonder (mother, father, or other caregiver) and the child go to a park. The caregiver says 'dog', pointing towards a dog. The child hears and sees the other doing it, and at the same time sees the dog in the direction of the bonder's gestures and gaze: a relatively moving whole of 'lines' in a relatively constant environment. Accompanied perhaps by more sounds, for example of the dog barking. Next time they go to another park and see another 'dog'. Over these multiple yet similar experiences the child learns, through covariation, the concept of dog, including diverse examples of it as well as the name or sound of the concept. A 'dog' can look differently, but they mostly have a certain form, they bark and have a size within a certain range. Of course the child also learns the concept of 'park', in a similar way, by diverse personal, 'bodily', experiences. A park mostly has trees, sometimes a lake or a river, grass, people playing, walking, and the like. Entities that are grasped through differentiated sensual experiences: feeling water, seeing and touching 'green' grass, climbing a tree, walking around these qualities, touching and moving. Body experience is a basic characteristic form **concepts**. Adults already know all these aspects of a park. They learned it in their childhood, in the frame of holding the hand of a caregiver, of carrying, or hugging, playing tag, walking and running around in the park.

Like this a child not only learns what a dog looks like and that it is called a 'dog'. It will also learn what tactile characteristics a dog has and what it can smell like. Through the number of moments and perceptions of the everyday, a child builds its concepts associating experiential covarying stimuli of all (differing) senses. There is no single concept. **Concepts define each other, by their relative contrast. Red versus white. Colour versus sound. Dog versus grass.** The elementary perceptive contrasts are fuzzily, but not without sense, intertwined: The colour 'brown' belongs to different concepts, i.e. tree, dog, earth, and so on according covarying experiences. A concept yet consists of relatively circumscribed elementary characteristics: A dog is rather brown or beige than blue, has rather four than three or two legs... though this is not totally unthinkable or impossible. Poodles are sometimes blue, a dog may only have three legs after it has been hit by a car.

Concepts are created by our unique life experiences. That is why no concept system will resemble another. That is why we're all special and unique. Asked for a 'typical' dog, different people may have varying pictures in their head coming from their personal experiences. Concepts are established as we meet them in our surroundings and those experiences are weighted and guided by bonding partners and the closeness and interactions they offer. Like this making experiences memorable and unique, giving them '**emotional relevance**'.

The aim of this text was to unravel the superordinate role of touch, moreover, of somatoception for psychological functions. Somatoception mediates life of the body and soul. It makes us feel there like no other sense, rewards and enhances our whole being. Notably, the sense of body has super-ordinate relevance in memory and psychic fluency. During my research I derived the following working **hypothesis for a holistic human consciousness comprising cognition on the fundament of intact emotional processing**: *Consciousness IS by the degree of differentiated impressions (neurons) in their weighted association-by-emotion.*

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Carey LM1, Abbott DF, Harvey MR, Puce A, Seitz RJ, Donnan GA.

BACKGROUND:

The neural basis underlying somatosensory impairment and recovery poststroke is virtually unexplored.

OBJECTIVE:

To investigate the relationship between touch discrimination impairment and task-related brain activation in stroke survivors with somatosensory impairment following subcortical or cortical lesions.

METHODS:

A total of 19 stroke survivors with touch impairment were investigated using fMRI and a touch discrimination paradigm 1-month poststroke; 11 had subcortical and 8 cortical sensory lesions; 12 age-matched healthy controls were also studied. Mean task-related contrast images were regressed with sensory impairment using random effects analysis for each subgroup and the total group.

RESULTS:

There was no significant difference in touch impairment between stroke subgroups. Touch discrimination of the affected hand correlated negatively with task-related activation in the ipsilesional primary somatosensory cortex (SI; adjacent to the SI hand area activated in healthy controls); ipsilesional secondary somatosensory cortex (SII); contralesional thalamus; and attention-related frontal and occipital regions in the subcortical group. In contrast, the cortical group did not show significant correlated activity. Yet there was no significant between-group difference in a priori somatosensory regions: only in the superior medial frontal gyrus. A negative correlation was observed in the contralesional thalamus for the total group, irrespective of lesion type.

CONCLUSION:

The findings provide novel evidence of neural correlates of poststroke touch impairment involving a distributed network of ipsilesional SI and SII, the contralesional thalamus, and frontal attention regions, particularly following subcortical lesions. Further systematic investigation

of a modulatory role for ipsilesional SI, the thalamus, and frontal attention regions in sensory processing and recovery is warranted, particularly given implications for rehabilitation.

[Sub-threshold cross-modal sensory interaction in the **thalamus**: lemniscal auditory response in the medial geniculate nucleus is modulated by **somatosensory** stimulation.](#)

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