Self-Attachment: A New and Integrative Psychotherapy

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Emotional Health and Attachment Types

- Our psychological and emotional health is strongly correlated with the type of secure or insecure attachment we developed as children with our primary caregivers.

- Early programming: The attachment schema regulates the genome and sculpts the stable patterns in our implicit memory as "our internal working model" that become the basis of our outlook and conduct in the social world.

- In the West, some 35% of the population is estimated to be insecurely attached. For developing countries this rate is much higher. It leads to trans-generation of insecure types.

Motivation, aim and method

- Consider the human brain as a biological computer with the brain's neural network as its architecture and the individual as the user and the operating system.

- "Psychopathology is mostly rooted in sub-optimal neural development and integration in early implicit learning."

- Develop an easily usable self-help therapy to effectively overcome psychological disorders to break the cycle of transmission of insecure attachment types.

- Present a retraining algorithm called **self-attachment** to construct optimal neural development and integration to increasingly contain and isolate pathological neural circuits.
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Comparison with Synthetic Biology
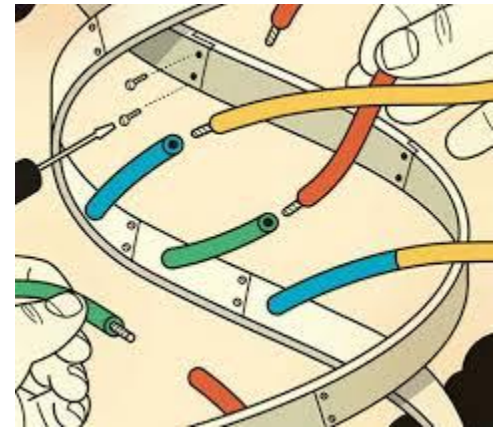
- Genes are the building blocks of biological species.

- In synthetic biology, one inserts genes from one species into another species.

- Attachment types and the resulting "internal working model" can be considered as the building blocks of human psychology for social interaction.

- Having identified this building block, how can individuals suffering from malfunctioning building blocks be endowed with healthy building blocks?

The basic ingredients of self-attachment

- Attachment theory
- Developmental neuroscience and attachment theory
- Neuroplasticity and Long Term Potentiation
- Model of attachment types in Attractor Neural Networks
- Evidence for self-attachment from Ethology and Anthropology
- Self-attachment therapy, results and interpretations

Attachment theory

• Dominant paradigm in developmental psychology pioneered by John Bowlby.

• A toddler has one of four types of **attachment** with her/his primary caregiver depending on their relationship, crucial for the child's emotional development and the "internal working model" in life:

- **Secure attachment** (loving parent)
- **Avoidantly insecure** (rejecting parent)
- **Anxiously insecure** (inconsistent parent)
- **Disorganisedly insecure** (frightening parent)

Strange Situation Experiment

• A twenty minute experiment across different
cultures with a mother, her one year old toddler,
a stranger and a room full of toys.

• The mother twice leaves the toddler and then returns,
the first time with the stranger present in the room.

• The toddler's reunions with the mother are carefully observed:

❑ **Securely attached**: the child is quickly comforted by the mother

❑ **Avoidantly insecure**: the child avoids eye contact with the mother

❑ **Anxiously insecure**: the child cannot be comforted by the mother

❑ **Disorganizedly insecure**: the child freezes, sometimes collapses

# Secure attachment circuits in the first year
(Allan Schore, 2003)

• The loving mother - through mutual gaze, mirroring, singing, dance and play - attunes, resonates and fine tunes with and thus regulates the baby's affective states, maximizing positive and minimizing negative affects.

• Synchronized **right brain – right brain interactions** in the **mother-baby dyad** greatly increase dopamine and endogenous opiates, inducing rapid growth of the baby's brain.

• The **orbital prefrontal cortex** develops as the executive director of the limbic system, to regulate and delay response to arousal of emotions.
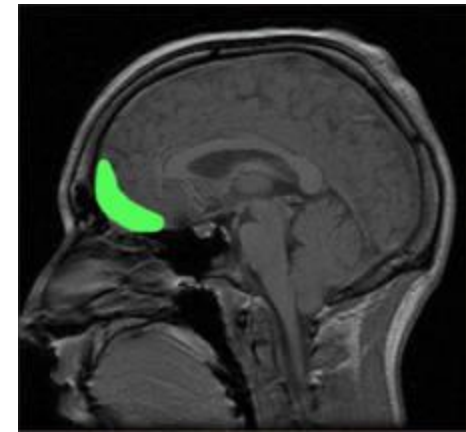
• The child slowly acquires a mental image of the loving mother, an internal model/neural circuits used increasingly in the absence of the mother too.

Orbital prefrontal cortex

Second year: socialising
(Allan Schore, 2003)

• In the second year, the mother plays a **socializing** role to persuade the child to restrain unsafe and anti-social actions the child enjoys.

• By repeated experience of mis-attunement, shame and re-attunement the child learns that disruption in homeostasis can be set right.

• **The child develops a capacity for self-regulation by internalizing the mother's capacity for self-regulation**.

• The bond **"circuits"** in the child's brain expands to include stable circuits for self-regulation.

• The securely attached child can grow up to have a pro-social "internal working model".

Insecure attachment

 (Allan Schore, 2003)

• Babies instinctively seek secure attachment with their caregivers.

• But, due to many possible reasons, the mother of an insecurely attached child reacts to his/her emotional needs by rejection, ambivalence, or even fright.

• As a result, the child does not develop the capacity for arousal modulating and affect regulation, which leads to emotional dysregulation and toxic brain chemistry.

• This causes long-enduring defects in the orbitofrontal cortex, later resulting in a non-optimal "internal working model" with possible anti-social behaviour, psychological/ psychiatric disorders.

• Insecure attachment induces **addiction to dysfunctional thoughts and behaviour that are socially maladaptiv**e.

Human bonding examined with fMRI

(Bartles and Zeki, 2004: Neural correlates of maternal and romantic love)

• Mothers and adult lovers look at photos of their loved ones and of some friends.
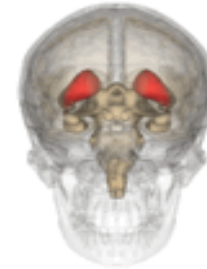
• Activated brain areas of mothers significantly overlap with romantic lovers in **dopamine** producing caudate nucleus, the **reward pathways** of the neural network.

Caudate nucleus

• Similarly, deactivated brain areas for maternal and romantic love significantly overlap in regions associated with negative emotions and social judgment.

• **"Love is an addiction" but is biologically and socially adaptive.**

"Falling in love" and "loving"

• "Falling in love" is the **formation** of a bond whereas "loving" is the process of **maintaining** the bond. (John Bowlby)

• Infant and adult love both involve eye-contact, touching, caressing, smiling etc.

• Several hormones and neurotransmitters in particular **oxytocin** and **endogenous opioids** act to promote maternal behaviour and pair-bonding.

• Reduce anxiety/anger processed by amygdala in limbic system, producing positive affects.

• fMRI images show frightful faces/scenes trigger a dramatic reduction in amygdala activity in subjects who sniff oxytocin, suggesting it creates tranquility and trust.

NIMH Genes, Cognition and Psychosis Program
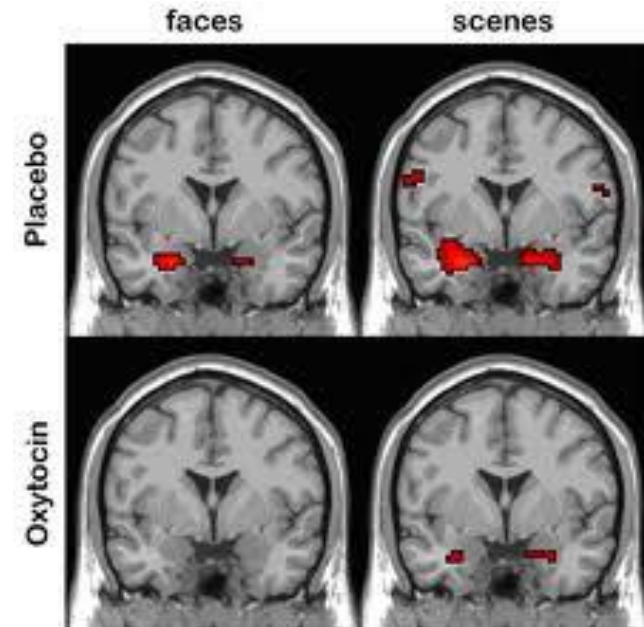
Neuroplasticity and Long Term Potentiation

- Neuroplasticity: The brain can change structurally and functionally by new learning in adulthood and old age.

- Explicit learning by LTP: Persistent increase and long lasting enhancement in synaptic strength between two neurons firing together by repeated simulation.
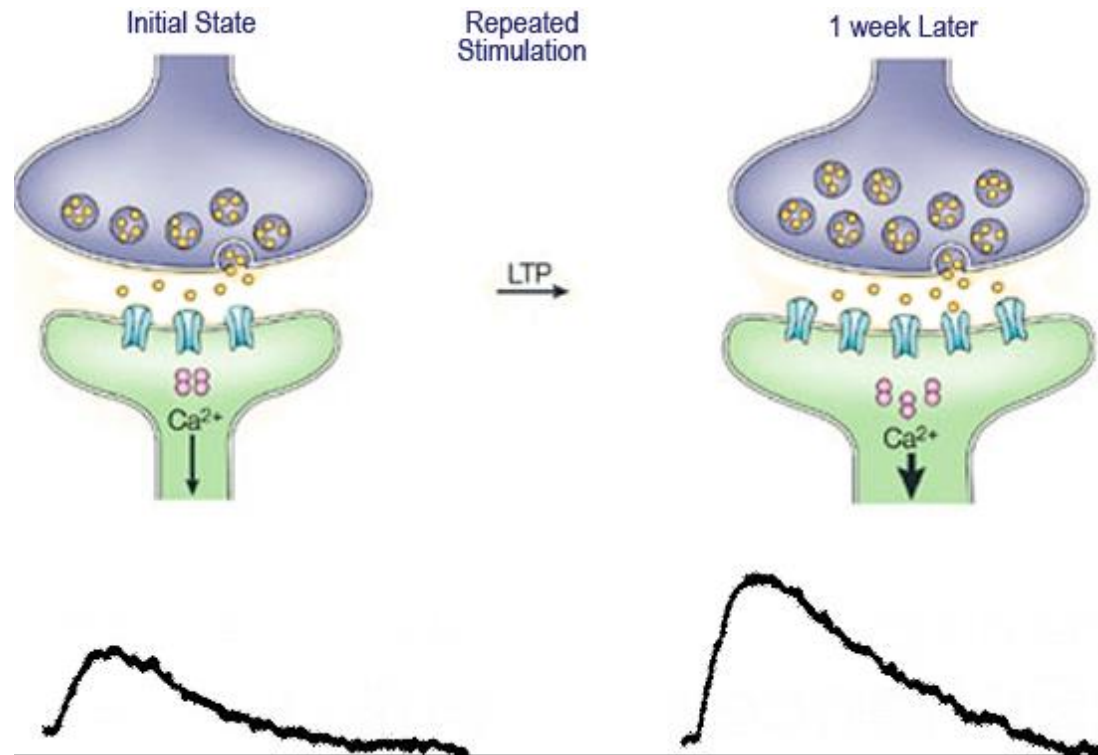
- **Hebbian rule**: Neurons that fire together wire together; neurons that fire apart wire apart.

Modelling attachment types in neural networks

- Hopfield neural networks are used to store and retrieve memory.

- A neuron either is on with value 1 (firing) or is off (not firing) with value -1, a vast simplification of the real situation.

- Between any two neurons there is a connection weight

- The state of neurons (+1 or -1) will be renewed one at a time depending on the states of other neurons and the weights.

- Hopfield network with N nodes is initially trained to store say p patterns or memories using a Hebbian learning rule.

- The network has an energy value for each configuration which decreases any time the network is asynchronously updated.

- It is then able to recognise any of the learned patterns by exposure to only partial or even some corrupted information about that pattern, provided $p/N < 0.138$, the network capacity.

Left window — Hopfield neural network usage Example

Create Neural Network (100 Neurons)
Add pattern to Neural network
Run network dynamics
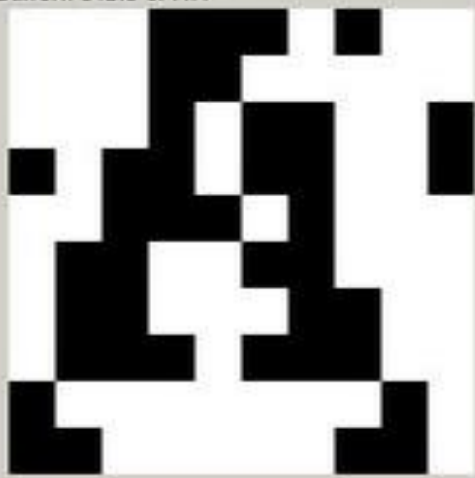
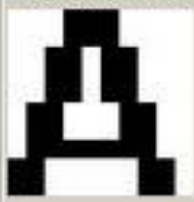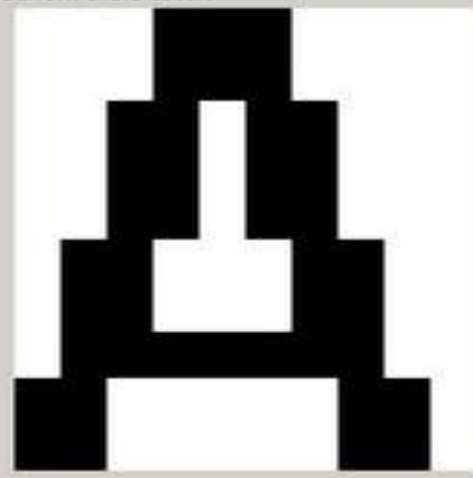Properties of Neural Network

Size of Neural Network: 100
Number of patterns: 3

Current value of Energy: 0

Current State of NN

Patterns in NN

Right window — Hopfield neural network usage Example

Create Neural Network (100 Neurons)
Add pattern to Neural network
Run network dynamics

Properties of Neural Network

Size of Neural Network: 100
Number of patterns: 3

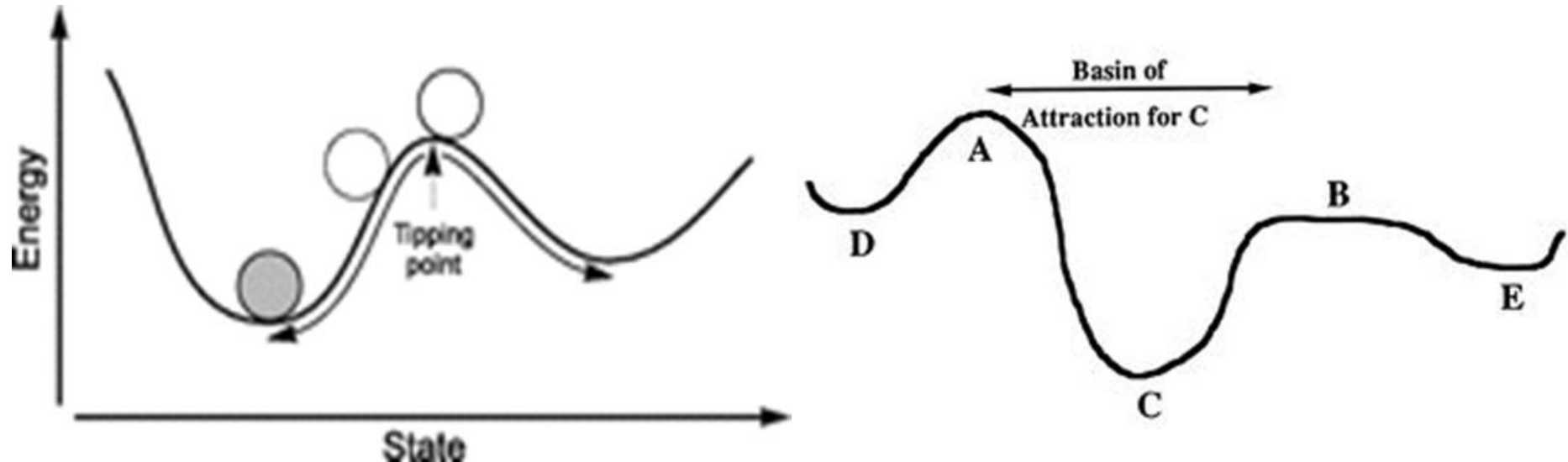Current value of Energy: -5542

Current State of NN

Patterns in NN

Each stored pattern corresponds to a minimum of the energy landscape, an attractor of the network.

Any attractor has a basin of attraction.

The network settles finally in the minimum with stored pattern closest to the initial pattern.

Attachment types as strong patterns
AE 2012, AE and F. Mancinelli (IJCNN 2013)

- An attachment type is the cumulative result of thousands of qualitatively similar interactions with a primary carer.

- A **strong pattern** is one that is **multiply** trained in the network

- We model attachment types by strong patterns creating strong attractors with a large basin of attraction.

- **Bond formation = Creation of a strong attractor**

- **Retaining the bond = Increasing the degree of this attractor**

- By solving the mean field equations for the stochastic model, the capacity for retrieving a strong attractor with degree d is shown to exceed that for a simple pattern by more than square of the degree d. (AE 2013)
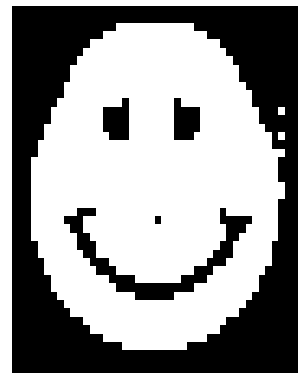
A simple experiment
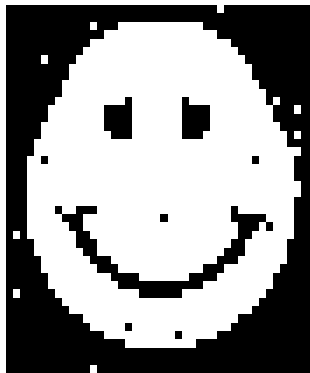
- We train the network with 50 copies of a happy smiley
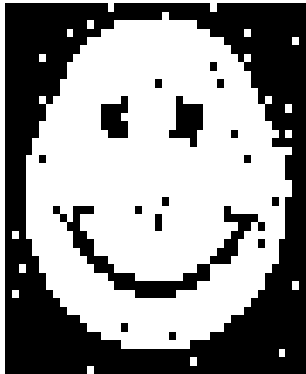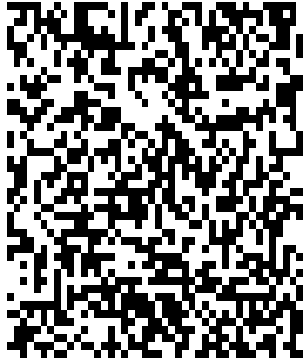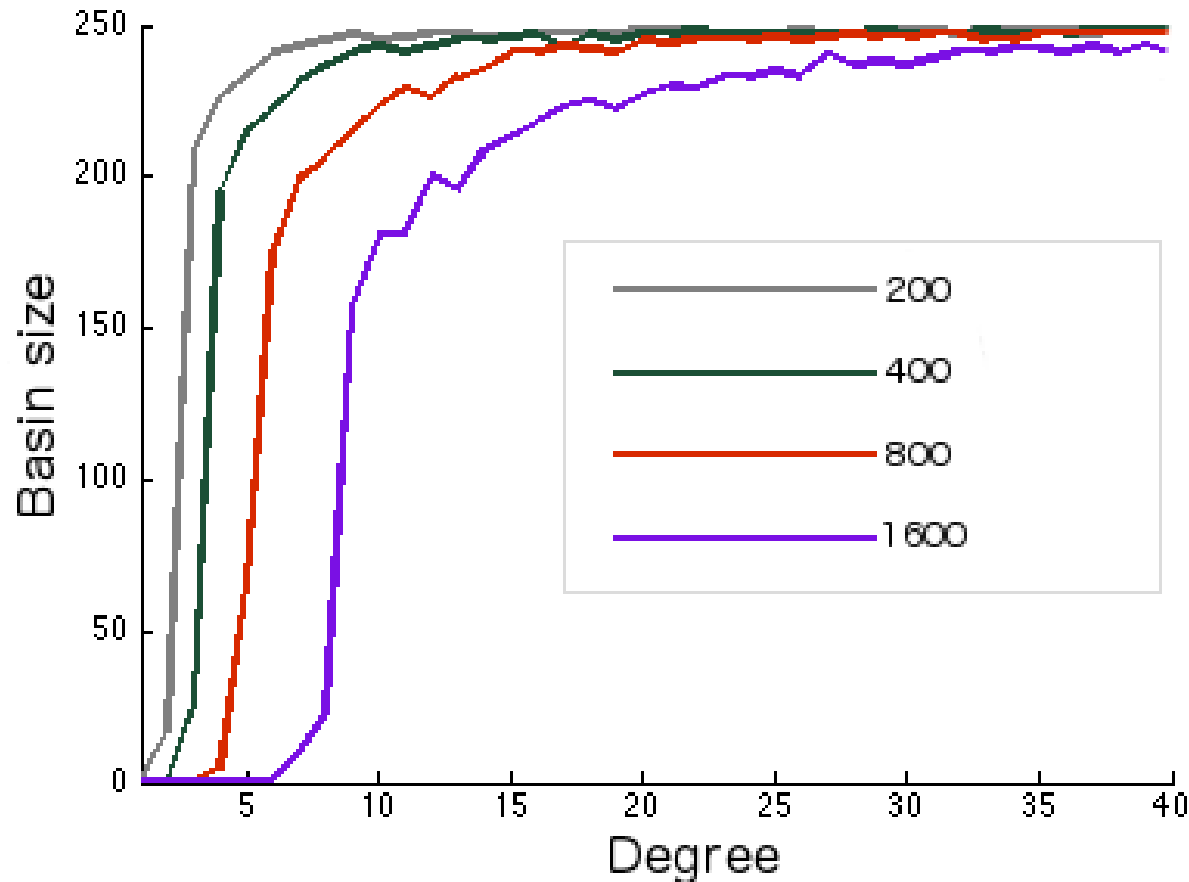

- 30 copies of a sad smiley

  and single copies of 1000 random faces.

- We then expose it to a random pattern to see what pattern is retrieved.

- There are 48 x 48 pixels (neurons) on the screen.

Basin size of strong attractors

N=500 neurons

One strong attractor with different degrees and different no. of random patterns as in the coloured curves.

Challenging a strong pattern by another pattern

- We now train the network with

1. a cluster of d1 similar patterns, and

2. a second cluster of d2 similar patterns

- We obtain the size of the two domains or basins of attraction of these strong patterns by exposing the network with a large number of random patterns one at a time.

Distance of a recalled pattern from two strong stored patterns with different degrees
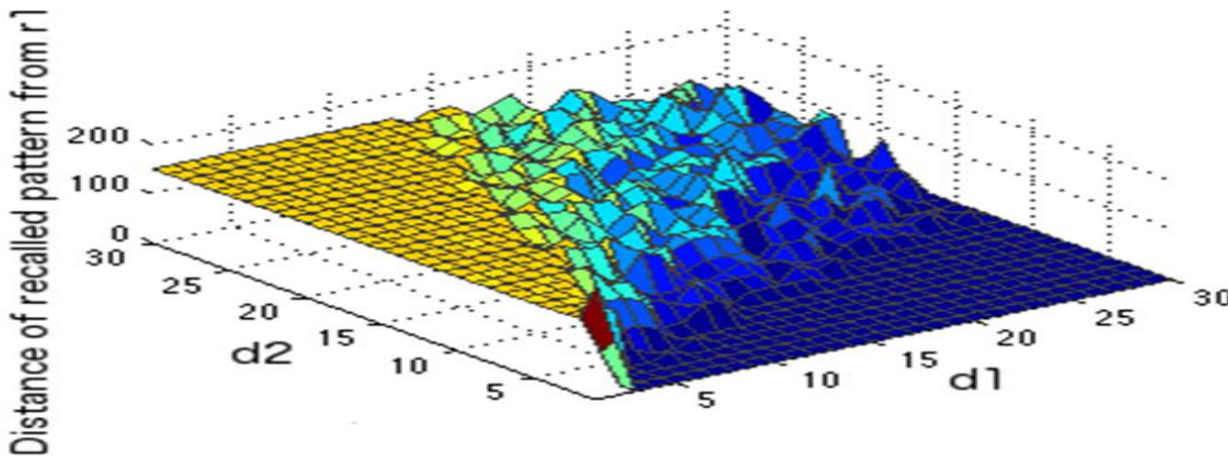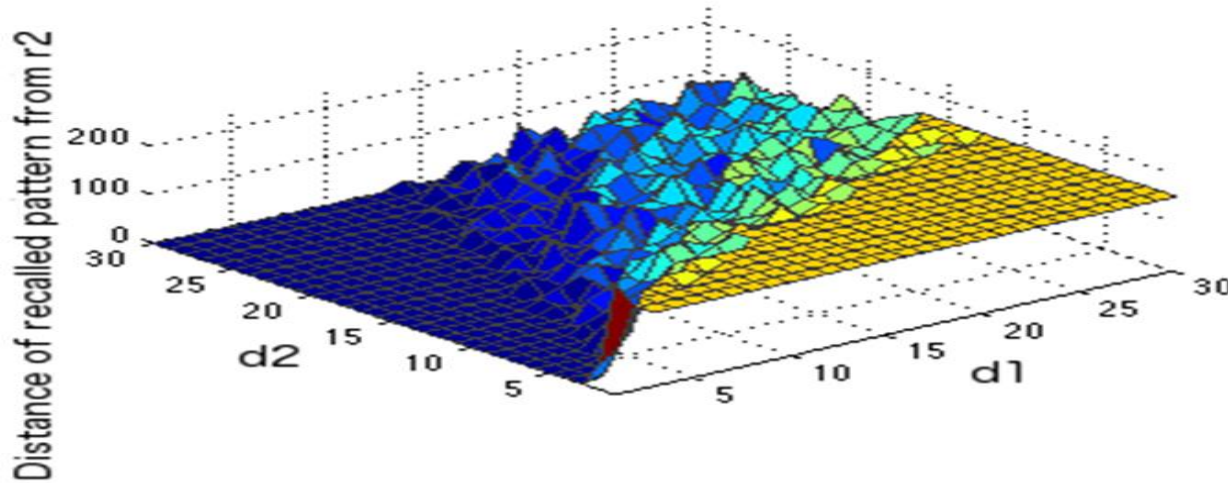
Basins of two competing strong patterns
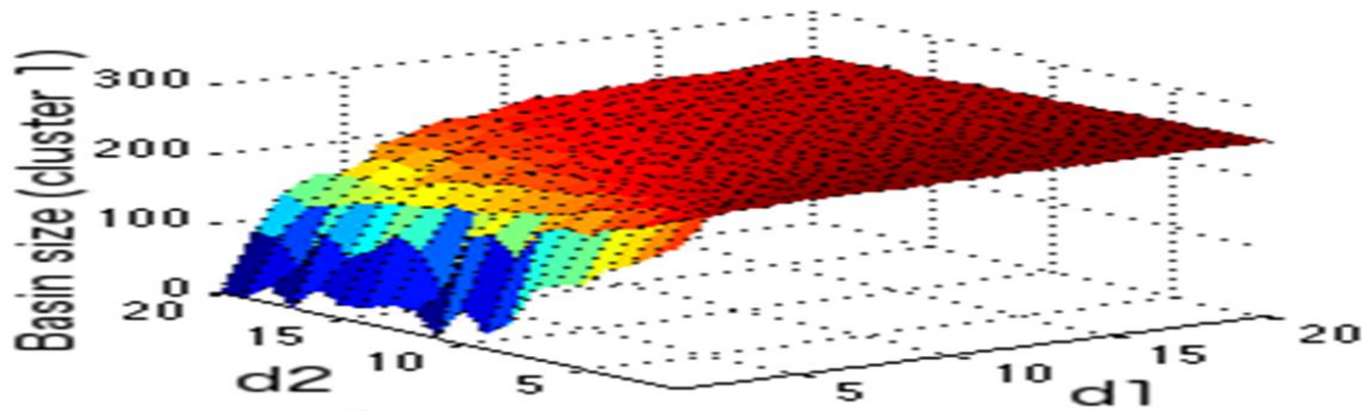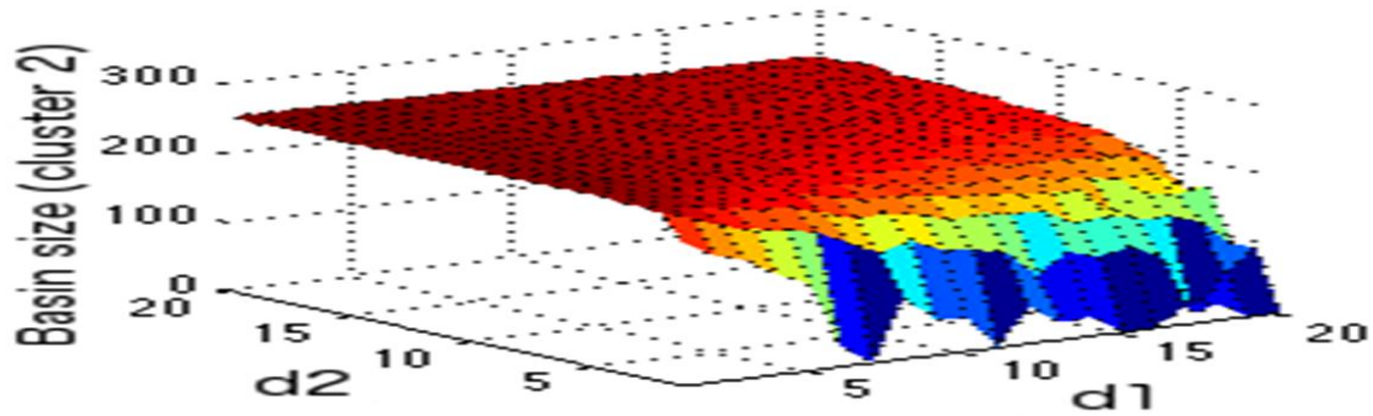
Model for change of attachment type

• A successful psychotherapy can be considered as a changing and evolving landscape of attractors corresponding to attachment schemata.

• Initially, there is an equilibrium **I** corresponding to an insecure attachment schema, a strong pattern.

• Then a new strong pattern **S** for secure attachment is created.

• By repeated training, the degree of **S** gradually increases to a new dominant equilibrium state with overwhelming basin of attraction.
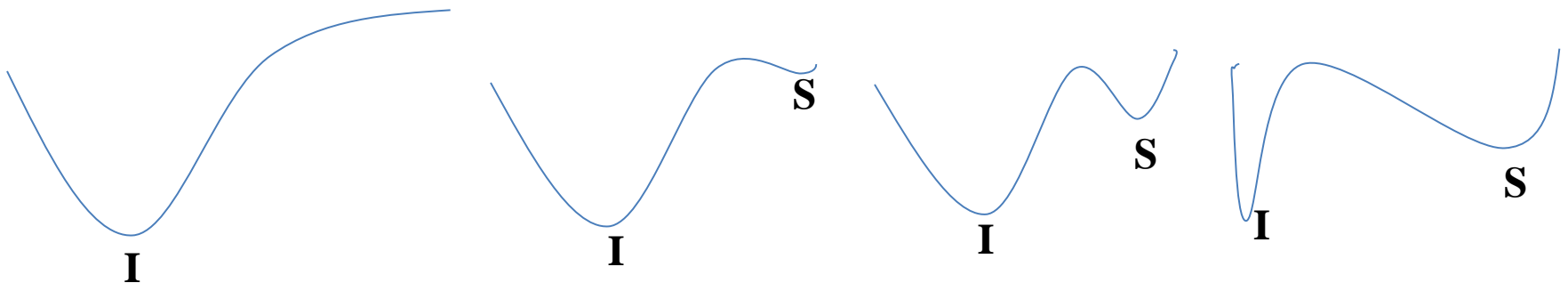
Attachment Behaviour in Ethology

- Despite Konrad Lorenz's **imprinting experiments with graylag geese**,

- and despite Harry Harlow's **cloth covered surrogate mothers** for rhesus monkey infants,

attachment theorists have insisted that attachment bonds take shape only between conspecifics.

Rudiments of Self-Attachment in Ethology
(John Capitanio 1986)

- Non-human primates exhibit abnormal **self-directed behaviour** when subjected to isolation in their early lives.

- One type of self-directed behaviour mimics certain calming or stimulating interactions with a mother monkey

- In the absence of an object to suck on, cling to or be stimulated by, the isolated infant monkey engages in **self-orality, self-clasping or rocking**.

- Since these self-directed behaviour are not learned, they must be part of the **attachment system** and thus biologically adaptive.

Other Attachment Bonds in Humans

- With their large pre-frontal cortex, humans invest high emotional significance to and **bond with inanimate or abstract objects**, which mediate self-directed behaviour to contain anxiety and provide inner peace.

- Donald Winnicott: Children passionately bond with "**transitional objects**" such as a pillow or a blanket as **a mother substitute.**

- Anthropology: Humans have created **passionate beliefs in artefacts , spirits, deities and scriptures** and have used their intimate bonds and abstract relationship with these objects combined with a whole range of rituals **to regulate their strong emotions and harmonise their social relationships**.

- These schemes are precursors of Algorithmic Social Intelligence.

Self-Attachment therapy

- The brain is comprised of "**two individuals**":

  (i) **Adult self**: a thinking/reasoning faculty with neural activities in the pre-frontal cortex or "left" brain
  (ii) **Inner child:** a feeling/emotional faculty with neural activities in the limbic system or "right" brain

- **Self-attachment algorithm:**

1. The adult self **connects** to the inner child with **compassion**.
2. The adult self creates an **internal affectional bond** with the inner child, subjectively experienced as **"falling in love".** (Hardest part)
3. The adult self practices **training sessions** with the inner child designed to **regulate affects** and **maximise joy** in the inner child.

Self-attachment mimics mother nature with a twist

- The **right brain-right brain interaction** of parent and child is replaced with an internal **left brain – right brain** interaction..

- The **left brain** replaces the **good enough mother's right brain** so as to re-raise emotionally the insecure inner child.

- The internal affectional bond is experienced **passionately with secretion of dopamine in the reward system of the brain.**

- The internal bond creates **new neural circuits** in the brain.

- The training sessions **use negative and positive feedback** loops in the brain to **regulate emotions and maximize joy**.

- Neuroplasticity /LTP strengthen the bonding circuits and establish a secure attachment type with a new internal working model.

Two examples of exercises

- **Affect regulation for a trauma:** The individual imagines the traumatic scene in which the adult self imaginatively intervenes to comfort verbally and physically the inner child.

- **Habituation to singing a favourite happy song:** The individual learns the song by heart and sings it to the inner child with the imagination that it helps to raise the child to emotional maturity.

- Combine the two exercises above to get a treatment of PTSD.

Results of experiments

- Six individuals in the UK and US have practiced self-attachment for various periods in the past three years. **Full data on two cases**.

- Age range: 30-60

- All had previously at least one form of therapy (Cognitive Behavioural, Psychodynamic, Psychoanalysis).

- All reported a significant transformation in becoming "emotionally mature" with sharp reduction in anxiety/depression in a few weeks.

- Two cases of chronic depression /anxiety reported their **emptiness and helplessness** disappeared, sense of **agency** and **self esteem**.

- Under high levels of stress they still slide back temporarily to their disorders but increasingly with much reduced pain and duration.

Interpretation

- The training exercises produce an inbuilt a "mood up-lifter" and an "anxiety manager".

- **Passionate bonding** is why it works effectively.

- Hypothesis: Self-attachment **creates new optimal neural circuits** connecting orbital prefrontal cortex and the limbic system, increasingly containing the old pathological circuits.

- In layman's terms, the individual builds up adequate resources provided by the exercises to cope and enjoy life.

- In Kohout's self-psychology, an **empathetic self-object** is created.

- In Kleinian terms, a **good object** has been **internalised**.

Current and future work

- A self-attachment model in sparse neural networks.

- A brain model with hidden layers for self-attachment

- A computer game for self-attachment

- A virtual reality environment for practicing self-attachment

- Controlled clinical trials.