Education and Culture DG

Learning Processes in the Light of Neurological Research

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MANUAL FOR BRAIN-USERS

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Work papers of the European Learning Partnership « Art, a basic human need. Neurodidactic answers to increasing social challenges » Seminar 23rd - 25th October 2009 in the Geschwister Scholl Schule Tübingen and presentation at the Round Table "The Russian Language in the UK" at the Royal Overseas League House, London, 14, November 2009.

"We can no longer allow ourselves to act as though we know nothing about the functioning of our most precious resource: the Brain. "
Prof. Dr M. Spitzer

The aim of this European learning partnership is the promotion of transfer and cooperation between sciences and education in order to meet current social challenges more efficiently. This paper is meant to be a practical tool providing useful references of scientific information. In response to the wish expressed by some participants, the chapters are completed by didactical recommendations. Together with the summaries in the index, this can provide an overview with no necessity to study the details given in the chapters.

This paper does not claim to provide complete coverage of the subjects dealt with. Its sole purpose is to elicit the joy of discovering a territory which is most personal as well as most common: our brain as the source of all progress and future solutions.

It has been translated by the partner institutions into German, French, Lithuanian, Czech, Turkish, Polish and Russian in order to create an Internet-Centre for transfer of educational research and practice. www.didactic-pilot.eu makes information about the current neurological research on the learning process as well as the possibility to exchange advice and to download teaching material available. In brief: the aim is an Open Online University as a platform for mutual qualification of its users by rapid transfer of research results as well as best practice reports in order to respond to the increasing challenges in education.

We are happy for every reader to participate actively by feed-back, contributions, additions and recommendations and we would be grateful if you introduce this site to local networks.

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Introduction

In talking about neurodidactics (brain adapted learning) we are looking at two directions that need to be united for the benefit of our future:

- At all times in history there have been educators who have had the right feeling for dealing appropriately with our brain, the most sensitive and most precious organ we have.

- The invention of Functional Magnet-Resonance-Imaging (FMRI), however, now allows for the non-abusive scientific investigation of brain functions in vivo and, therefore, provides definite facts where before solely personal instinct was the guide.

As the mind did not lend itself to measurement before, sciences had been divided into humanities, based on ideologies, and natural sciences, based on facts. While educational issues, being part of social sciences, are currently still handled within humanities, biologists and neurologists are now producing sensational findings and previously ideology-based faculties are shifting towards fact-based cooperation with natural sciences.

The brain has become the 'new continent' – or even the 'new universe' - mankind is starting to discover.

Results such as deep-brain-stimulation by electronic implants in the brain, enabling one e.g. to remote control bulls in the arena, or enabling chronically depressed people to work efficiently in good mental health without medications (Dennys, Berlin 2009), are only heralds whose impact on our civilisations cannot yet be measured. Controversial endeavour marks the horizon at the dawn of a medical and educational revolution. While the OECD, for example, in 2003 declared "the promotion of boys' reading ability to be the primary aim of education worldwide" (P.T. Magazin 2007), scientists are beginning to discover that the educational achievement of boys depends on the use of their motor abilities at primary school. Eighty per cent of all pupils with learning disabilities being boys, the media[1] are now complaining about "the breeding of illiterate working and paying slaves of the male gender" and it is time to investigate whether 'nature or nurture' is responsible for their educational failure.

So far, results of neurological research are primarily applied by commercial institutions (neurolinguistic, neuromarketing, neuroeconomy), and particularly in child-directed advertising! (Noonan, Berlin 2009). But the need for future development potential worldwide undoubtedly demands the immediate use of discoveries applicable to educational issues. Systematic record-keeping, now accessible via the internet, has already resulted in teachers starting to act as scientists, by dropping or keeping programmes according to their evaluation results. FMRI now allows education to move from being authority-based to evidence-based and hereby a user-focused science, just as medicine did a century ago (Spitzer, Berlin 2009).

Considering that

a) natural sciences are currently discovering the undesirable effects certain aspects of the customary curricula have on the brain's development, even including atrophy of neuronal cells,
b) violence shown by pupils is increasingly endangering school life,
c) over 90% of all teachers are currently forced to accept early retirement due to their health concerns (Netzzeitung 2001),

we cannot wait the usual time for the benefit of scientific discoveries to pave its way from the ivory tower of science to daily life.

At the 5th World Symposium "DECADE OF THE MIND" in September 2009 in Berlin scientists urged, therefore, for a greater application of research in the public domain, stating that cooperation with the relevant authorities is impeded by their lack of experts (Noonan, Berlin 2009).

As "education is our most valuable asset for present and future generations" (Angel Gurria, OECD Secretary-General 2007) pilot programmes investigating the neuronal suitability of their learning methods should, therefore, be among our foremost commitments, and education for everyone, as one of the human rights, could conquer new horizons.

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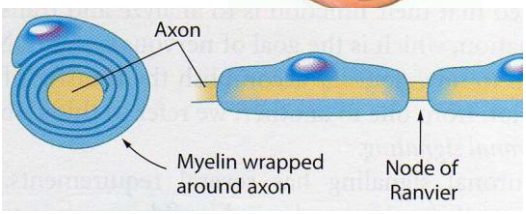
BIOGRAPHY IN THE BRAIN
and GENDER-DEPENDENT DEVELOPMENT

Critical Periods and the survival of neuronal cells

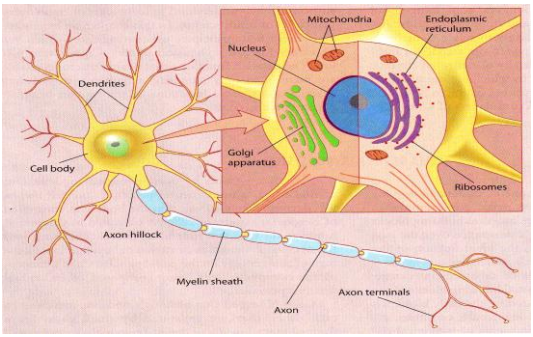
The brain is eager to learn: neuronal cells not used at the right time will die. (sensory deprivation)

The existence of time windows, when specific brain circuits are particularly receptive and need signals to develop normally, became a focus of scientific research through the behavioural observations of Konrad Lorenz (Lorenz 1977). Now Prof. Manfred Spitzer, founder of the Transfer-Centre-for-Neurology-and-Education at the University of Ulm, calls these "areas go online" (Spitzer 2002, 233 ff). This is the phase during which a specific neuronal area insulates its 'cables' (axons) with a white layer of fat (myelin sheath). We use these axons (therefore called white matter) to link the information stored in neurons (called grey matter), which comprise the 'bark' of the brain, or the cerebral cortex.

Axons that are not myelinated (insulated) transport electrical impulses very slowly. The electrical impulse of "action potential in non-myelinated axons is processed at approximately 3 metres per second at the most" whereas a thick myelin sheath "increases the speed of the axon to 110 metres per second" (Spitzer 2002, 230).



It has been established that neuronal survival and the growth and improvement of synaptic connectivity patterns at axonal terminals depend on afferent electrical impulse activity (Asanuma 1990). It is the action potential frequency that proportionally increases areal growth, mitochondrial enzyme activity, micro-vessel density, sodium/potassium pump activity and 2-deoxyglucose intake (Purves 1992). The importance of afferent activity for each of these processes has been demonstrated (Mattson, Orlando, Goodman 1988).



Absent, **expert** or **inexpert** use of cognitive functions causes, respectively, either:

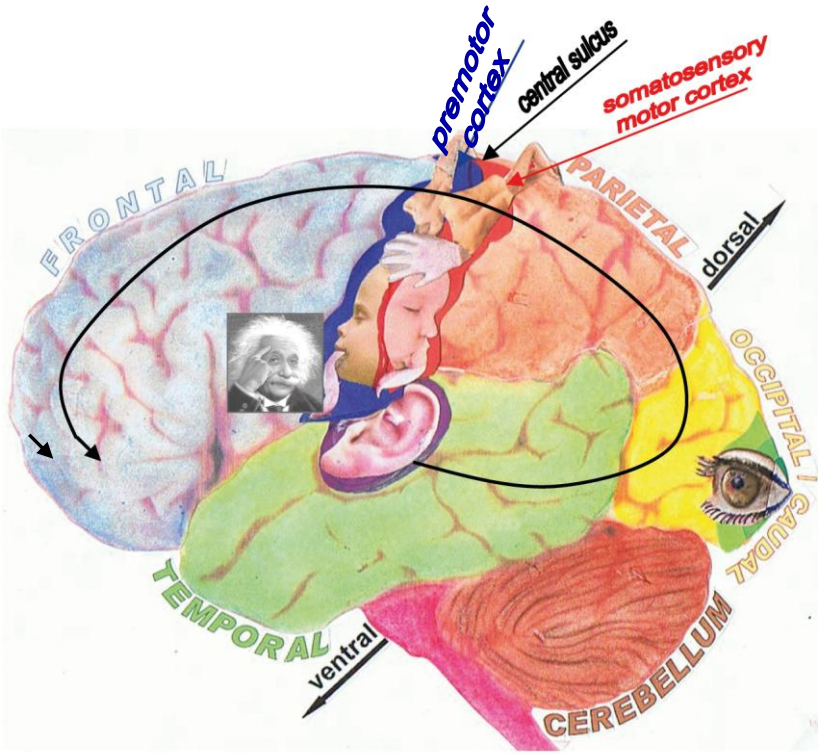
atrophy (Wolfe 2007), **growth** (Spitzer 2002, 64 f) or **deformity** (Polizei-Basis-Gewerkschaften 2006) of neuronal tissue.

The basic equation in the cited studies is the statement that **afferent electrical impulse activity (appropriate sensory stimulus) is as indispensable for neuronal tissue as nutrients are for metabolic organs** and that during critical periods the myelinating areas therefore express their need for nurture by driving the individual towards external releases for the relevant electrical circuits.

The CPH (critical-period-hypothesis) states that any connection (axon) *not* frequently used at its myelination period will disappear and the relevant "capacities will not be learned for the rest of the life". In brief: **Use it or lose it**. (Spitzer 2002, 240).

A baby's head, then, contains almost double the number of axons as an adult's head although the baby's head is approximately half the size of an adult's. The increase of the cranial volume is due to the myelin sheaths. Only axons insulated by the myelin sheath can be used efficiently.

For the infant, **myelination** begins with the **auditive cortex** in the **temporal lobe** and the **primer visual cortex** in the occipital lobe, as well as the areas for **touch** followed by the execution of **basic movements** in the **primer somatosensory motor cortex** (post-central-gyrus of the parietal lobe). The **premotor cortex** (pre-central-gyrus of the **frontal lobe**) follows and the most highly developed cortical areas of the **frontal lobe** will be connected fully with the rest of the brain only from puberty onwards (Spitzer 2002).



The neuronal basis for the **sensory functions** and **motor abilities** develops during primary school and requires maximal use of its functions to prevent its axons from becoming atrophied. Consider a two-year old child trying to catch a ball; he will never be successful in this because his arm movements are far too slow due to the lack of insulation of the required axons. At primary school these motor areas become insulated, so that actions such as this are carried out more and more successfully. However, at this stage, a comparable frustrating experience arises when the school child is confronted with abstract explanations; he is frustrated in his attempts to "catch" these because the areas for abstract thinking (ie. anything that is not tangible) only myelinate from puberty onwards.

Repeated training of areas that have not yet myelinated can, therefore, only provoke an aversion to this activity as success is physiologically impossible. At primary school age the frontal lobes are not yet insulated and, therefore, abstract thinking is physiologically not possible.

If you take the child's spelling and maths achievements as parameters for judging his or her motivation and IQ, the child will learn that effort is not worth while and will lose confidence in his/her future potential!	**Allow your children to develop useful routines for their future life instead of losing the axons needed for these manual skills due them not being used. Share housework with your children e.g. by setting up little competitions: the best salad, the nicest room, the quickest and most perfectly cleaned bathroom etc. (and if you participate in the competition admiring the child being better than you, then you win!). Teach the letters of the alphabet by modelling them and singing, teach mathematics using hands and objects, recite maths tables by clapping hands or throwing balls or walking along the 'geography' of the patterns on your carpet or the tiles of your terrace, assigning number sequences to locations. Do the same when learning e.g. geographical or anatomical names, discover science through the senses and history through captivating stories. During adolescence, when the intellectual competencies of the frontal lobe go 'online', your youngsters will discover the formulas, explanations and theoretical background of all this with curiosity thanks to its novelty appeal, instead of the surfeit accumulated by useless efforts during the years which should have served the development of motor abilities!**

Neuroplasticity: keeping pace with the current acceleration of cultural development

Although the neuronal connections not used during their critical phase disappear, subsequent efforts may, within certain limitations, stimulate the growth of new neurons and connections. This is a result of lasting afferent electrical impulses known as 'practising'. Nevertheless, the effort needed for this does not compare with the ease and pleasure of acquiring capacities like a gift during their critical phase. For example, a woman born blind who received treatment at the age of twelve was able to at least distinguish between separate objects and to localize faces twenty years after her surgery. (Pawan 2003).

This partial acquisition of functions over an extended period of time shows that the neuronal basis, which would have allowed the immediate acquisition of the entire visual capacities during the postnatal critical period, is no longer present. This example does not contradict the CPH but supports the theory of neuroplasticity, which suggests that the brain is adaptable: "injure an area of the brain, and another area can be encouraged to take over its functions" (Doidge 2007). Neuroplasticity has been proved on rats (Kis 1998) and on humans (Acosta 2002) of all ages (Doidge 2007, 259 ff).

Therefore, nothing is final. Everyone can increase any personal potential at any age! In particular parents and any teaching staff need to make use of their own neuroplasticity in order to tackle the current educational situation. For thousands of years life has hardly changed from one generation to the next. What applied during one's childhood could be used almost without restriction for one's children. However, the acceleration of the current cultural development demands a constant update of our neuronal programmes in response to rapidly changing situations; this is a challenge that cannot be dealt with by educational staff alone.

In Germany, for example, currently 60% of teachers suffer from burn-out and demoralization (Potsdam 2006), 23% neglect their pupils, giving priority to their own health, and over 93% are forced to retire early, most in their early fifties, due to depression and psychosomatic disorders (Errlangen 1999). Considering, furthermore, that, after road accidents, suicide is the second most frequent cause of death during adolescence, and that among the primary reasons for this are lack of confidence and parental pressure combined with pressure from school (Deutsches Ärzteblatt 2006), we have to recognize that education falls short of meeting current needs. (see „Hippocampus: The Novelty Detector").

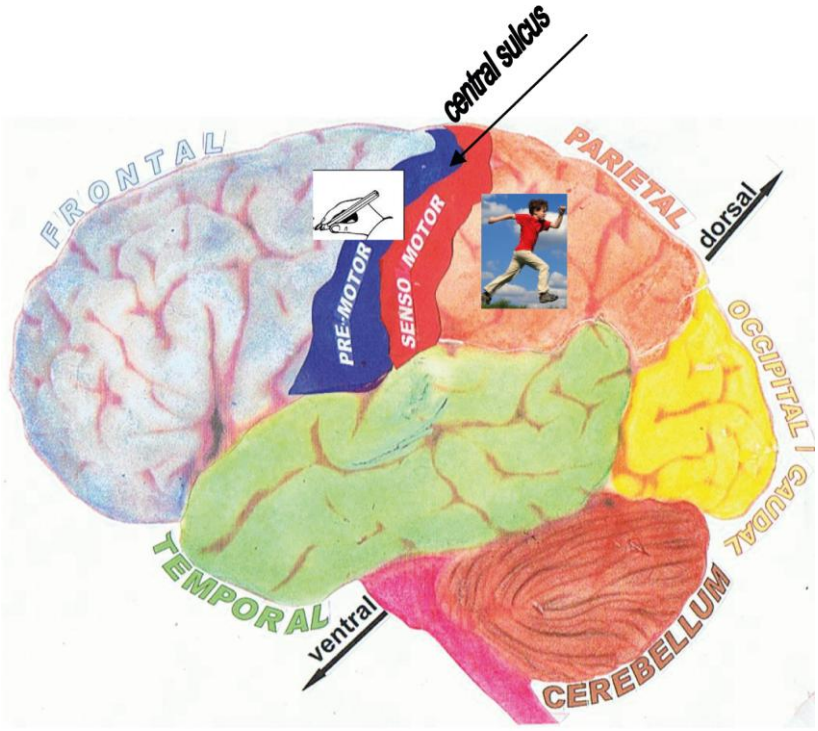
If you insist on children simply "cramming" because that is what has led you to success, they will be lost.	**Make use of your neuroplasticity by acquiring new perspectives and knowledge as well as new abilities which may even go against your habits, and you may discover a pleasure to learn which could have been hidden from you!**

Motor activity and dexterity: Gender competition or complementation

The **central sulcus** separates the **frontal lobe** from the **parietal lobe** between the **premotor cortex** and the **primary somatosensory-motor cortex.**

The **premotor cortex (M2, PMA)** at the precentral gyrus controls refined skills like dancing, learning from external contingencies e.g. good behaviour, memory and execution of precise movements patterns such as writing.

The **primary somatosensory-motor-cortex (M1, Brodman 4)** at the post central gyrus controls muscular power and the monitoring of the environment and space orientation.
(Ward 2006)



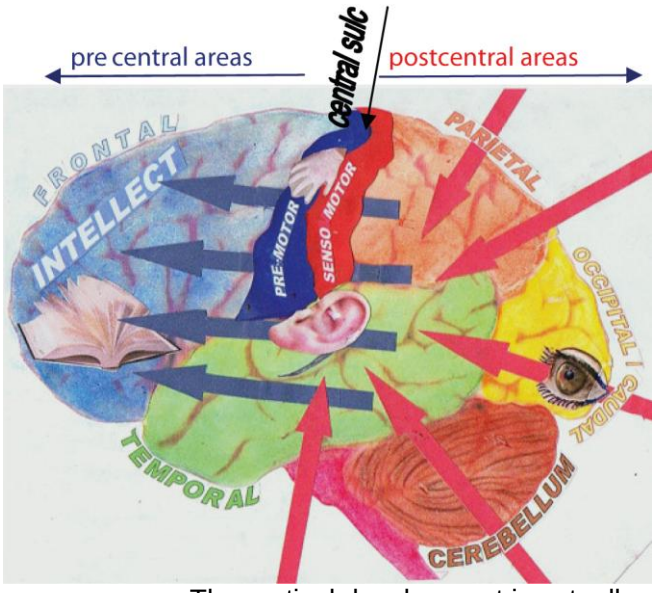
The reason why activities belonging to the **premotor cortex** are attractive for girls and why boys show interest for those rooted in the **somatosensory motor cortex** is that there is a chronological difference in their neuronal development. Current curricula are not conducive to the maturing of boys' brains, because they address mainly the **premotor cortex** at an age when it myelinates for girls while boys' brains are occupied with the myelination of the **somatosensory motor cortex.** (see also: equality in school: chronological differences of the critical periods for boys and girls").

If you try to stimulate the ambition of a boy by comparing his educational achievements with those of a girl, you will not be successful and this will not necessarily improve gender relationships!	**An appreciation of complementary abilities can support a better understanding of the subject dealt with and thereby enhance the achievements of both genders: e.g. boys could produce and construct items while girls would write about the subjects and be responsible for illustrations and documentation** (see also „No cognition without emotion".

Gender-specific equality in school:
Differences in the chronological order of critical periods for boys and girls

Firstly, I would like to remind you that not all boys and girls comply uniformly with the described characteristics. Due to the amount of testosterone present at specific moments during foetal development, cortical structures can be more or less 'male' or 'female' biased, irrespective of the person's actual gender (Birkenbihl 2004).

In boys muscle fibre constitutes on average 40% of the body, compared with only 24% in girls. Therefore boys have to myelinate almost twice as many neuronal connections of the **somatosensory motor cortex** and, accordingly, start **precentral** myelination in the **frontal lobe** later (Birkenbihl 2005). "The critical period of an area cannot begin until the input from the preceding area is ready" (Hensch 2004).



The origin of the input to different cortical areas is an important aspect, which should be considered for future curricula in order to support efficient neuronal development. The input for **post central areas** derives from the outside world via the senses, whereas for **precentral** areas in the frontal lobe only brain internal input is supplied. The development of intellectual abilities in the frontal lobe depends, therefore, on input previously provided to the **post central areas** via the senses. (Spitzer 2009, 148). Primary school syllabuses giving priority to learning via the **senses** and **physical orientation in space** would, therefore, be the basis for a rich and flourishing **intellectual development** subsequently. Boys in particular, not having sufficient access to the **premotor cortex**, need to maximise the activation of their **primary motor cortex** so that its axons are not lost during their critical period, but provide a large basis for the subsequent development of the **precentral areas** (Birkenbihl 2007). The cortical development is actually like a pyramid: the better the basis, composed of **sensorial** capacities as well as the following **motor activity,** is developed, the more extended the subsequent **intellectual development** in the **frontal lobe** will be when myelinating from puberty onward. In other words, the more the world is met through the senses and the more **motor** abilities are developed and refined first, the better the **intellectual** content will be assimilated during adolescence.

This offers an explanation of the contradiction that currently, for example, in Germany 80% of all children with learning disabilities are boys (P.T.Magazin 2007), while on the other hand more boys pass their baccalaureate with distinction than girls, who usually rank about the middle. A boy left to cope with the current curricula without help has little chance. A boy receiving appropriate support is able to develop a large **primero-cortical** basis, which his **intellectual** development can later be based on.

Considering that the symptoms of attention-deficiency-hyperactivity-disorder (ADHD) almost exclusively pertain to boys, it has been suggested, subsequent to what has been described above, "that a phenomenon such as hyperactivity might not be an illness to be treated with Methylphenidate (Ritalin) but might only reveal the fact that a pupil is concentrating on something different" (Langer 1998) in accordance with neuro-developmental needs. (Kohn 2009)

Nailing boys down on chairs and occupying them with books reduces the development of their future potential.	**If you refine the sensory and motor abilities during childhood by manual, musical, artistic and sporting activities and crafts, as well as by teaching the other subjects with a 'hands-on' approach, you will find brains eager to learn, especially in the case of boys.**

THE DAY SCHEDULE OF THE BRAIN AND THE IMPACT OF PRIMING

Stress destroys neurones: modern civilisation versus “reptile brain”

Panic or depression generates glucocorticoides via the limbic system and the amygdale, which inhibits the intake of glucose in neurons and hence also the inter-cortical connectivity. This means that the neocortical functions such as memory and reasoning are impaired. Chronic depression or a state of panic can even lead to the death of neuronal cells (Spitzer 2002, 167 ff).

This impairment of neocortical functions in stressful situations appears to be a certain incompatibility (Koestler 1978) of the neo-cortex with the stem-brain: “While our intellectual functions are carried in the newest and most highly developed part of the brain, our affective behaviour is still dominated by a relatively crude and primitive system, the limbic system in the trunk brain, whose fundamental pattern has undergone only little change in the whole course of evolution from mouse to man” (McLean 1983). This system, which phylogenetically is much older and therefore also called ‘reptile brain’, “enables simple routines to be done quickly and reflex-reactions, which are useful in prehistoric situations ruled by fight or flight.” Therefore, in situations of danger it impairs the creative associations of the neocortex (“new cortex”) in order to give primacy to reflexes (Spitzer 2002, 161).

However, in facing the challenges of modern civilisations the neocortex has generated, its creative associations are vital. And yet, being confronted with unexpected difficulties, the very functions that would provide the right answers, are still set ineffective: The functions of the limbic system stimulate the emission of stress hormones (glucocorticoids), blocking the neocortical functions where our knowledge and reflections are stored. In difficult situations, therefore, we are only able to think of the appropriate answer by stepping back and giving the brain the time it needs for functioning out of the stress mode.

Once we learn something under stressful conditions ruled by fear, the subject learned suffers from this effect of the stress hormones not only during the stressful moment, but becomes linked with it beyond the actually difficult situation (known Pavlov’s classical conditioning): while learning under a stressful situation, the neurons activated in order to store the required content build connections with the amygdale in the limbic system. So, even when the subject is later mentioned in a relaxed situation, the amygdale will be switched on automatically and will send the signal “fear” via this connection = emission of blockers = disconnection of the neocortex known as ‘black out’.

This is often the reason for continuous failing e.g. in mathematics. Something learned by heart (geographical names, anatomic vocabulary etc.) can also be reproduced (reeled off) under stress. However, a mathematical result can never be learned by heart but can only be developed by the functions of the neocortex. And this needs high connectivity, which is impossible under stress (Spitzer CD 2009). This can explain the known phenomenon of spiralling downward with decreasing motivation, resulting in chronic defeat in spite of every effort made (or in certain cases we therefore should say: ‘thanks’ to the effort made).

Summary: Thinking or telling unpleasant things reduces intelligence as it inhibits cortical functions.
Thinking or telling enjoyable things increases intelligence as it promotes intercortical connectivity.

Putting pressure on pupils by telling them that their achievements are insufficient will not be successful, because they will be neuro-chemically blocked.	**If you reiterate to the pupils again and again on every possible occasion that they have a real gift for the subject you are teaching, you will generate the emission of neuronal transmitters and even those who previously had difficulties will start to achieve.** (ccf. « Neuronal growth and atrophy : the impact of priming »)

Emotion and Reason: Where are they located?

Neocortex ('new' Cortex)
- phylogenetically the youngest part
- seat of our consciousness
- solution generator

Nucleus accumbens
- control of reward hormone emission

Cerebellum
- phylogenetically more than 100 million years older
- smaller cells
- control of motor structures and sensory perception

Brain Stem ('reptile brain")
- phylogenetically the oldest part
- control of emotion and gland regulation in conjunction with the adjacent limbic system

Limbic System

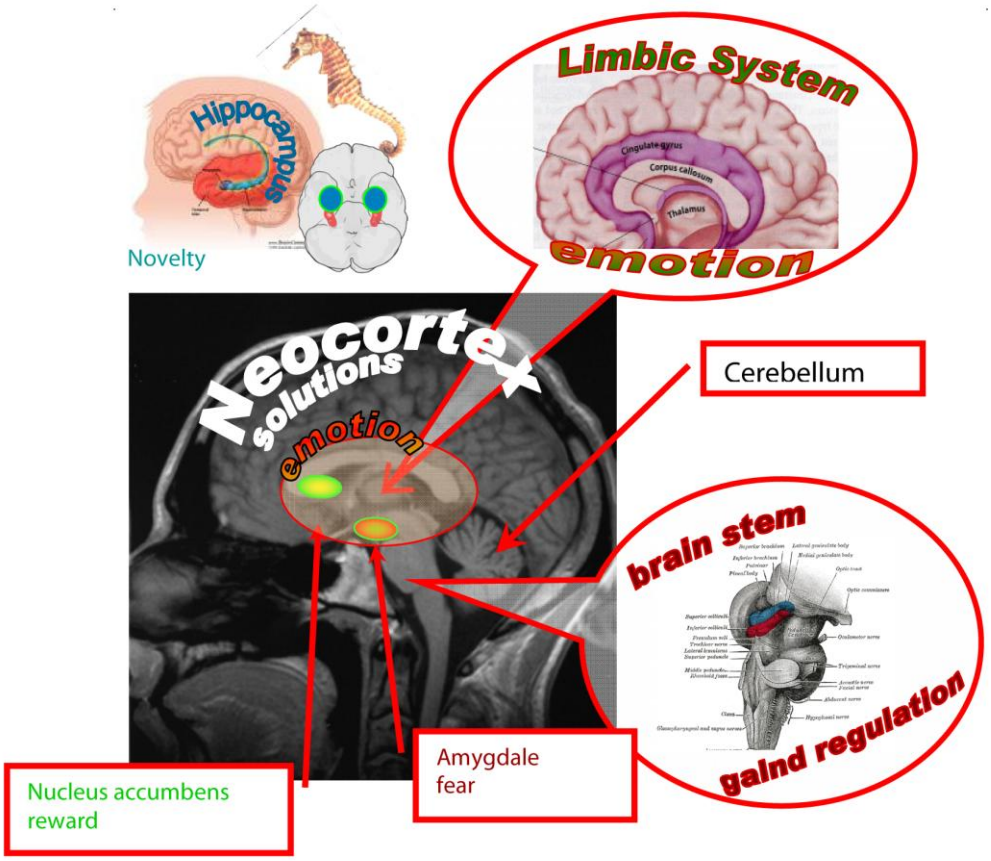
Amygdale
- fear

Hippocampus
- novelty detector

Gyrus cinguli
- heart rate, blood pressure

Hypothalamus
- hormone production and release

Thalamus
- link with cerebral cortex



The stem brain we have in common with the reptiles. It computes basic survival, our blood pressure and lung activity and fight or flight, defensive types of behaviours, which take but the individual it self in account. Reptiles primarily are solitary creatures. They don't interact with each other except for reproduction.

With the Limbic System mammals add on social skills. The mammal brain adds on basic nurturing types of behaviours and emotional content. It surrounds the reptilian core in the centre of the scull.

The neo-cortex (the "new bark") is the grey matter round the outside of the brain. It is the "hard disc" the elements of which are linked with each other by cables, the Axons. The cables are insulated with white fat and fill as "white matter" the space between the cortex and the Limbic System. The "bark" with the cables are the unique individual hardware which is programmed by its user's life and constitute his personality.

As the youngest part of the brain the neo-cortex computes conscious processes: the activity of our senses at the backside, the movements control around the middle (a strip from one ear to the other) and the frontal lobe, which is the part humans have hugely increase compared to mammals, adds on thinking, planning, vision, creativity, imagination.

"Imagination is everything.
It is the preview of life's coming attractions"

Albert Einstein

The hippocampus in the age of media culture: Happiness and learning are identical neuronal functions

The hippocampus is one of the most affected areas when it comes to the described lack of glucose intake in neurons due to stress. During protracted states of depression or panic it atrophies significantly. The hippocampus, also known as 'the novelty detector' or 'short-term-memory', 'scans' the entire external input, retaining only the novelties, which are afterwards (e.g. during the night) processed and conveyed to the other parts of the brain, where they will be saved to the long-term-memory. The hippocampus can, therefore, be considered to be 'sitting at the reception' of the learning process, choosing what is allowed to enter into the brain's memory = to be learned.

At the time when children were occupied in the afternoon only by daily repeated routines (help with hay-making, mucking out, etc.) the hippocampus threw itself eagerly on all the news presented at school during the morning. However, in an age when their attention is engaged by TV programmes, a new video game, the fashionable appearance of the others, etc., the hippocampus is over-charged with novelties. Being the one 'at the reception' who decides, the hippocampus will only allow the most interesting or flashy novelties to pass on into the brain. Words either written in a school book or mentioned by a teacher can, of course, in no way compete with the rest of the attractions.

It would, therefore, be easy to say that excessive distraction must be avoided, but the child has not yet myelinated the frontal areas, which would allow the child to consider and to take things into account other than what is in front of his or her senses. The child is, therefore, exposed to a 'media-addiction', ie the eagerness of his or her hippocampus for novelties. Since defence is known to attract, it is recommendable to suggest other activities in order to reduce media consumption, rather than restrict it solely.

Prof. Spitzer, founder of the Transfer-Centre for Neurology and Learning at the University of Ulm, emphasises the fact that, according to further research, the so called "happy centres" in the brain have proved to be "learn-centres": on a neuronal level, learning is to build and rebuild neurons and their connection. This process generates endorphins (natural opiates generated by our body). Due to its physiological conditions, the brain is actually addicted to learning. The heart cannot avoid beating, the lung cannot avoid breathing and the brain cannot avoid learning at any moment! If the brain was confronted at each age with what it needs at this specific moment for its maturation (and what it is, therefore, able to learn extremely quickly at that moment) school would be a place one impatiently longs for and "pupils would be upset when having to leave this place in the afternoon". (Spitzer CD 2009).

Preaching to children about the success of your own childhood efforts will only make them opposed because the conditions and challenges they are confronted with are not the same.	**Create a family timetable and have fun surfing together on Google for nice or funny illustrations in order to suggest outdoor games as well as shared household tasks. Above all, take the time to be curious (!), surprised (!) and delighted (!) about anything your child is able to tell you about his or her school lessons, then your child's hippocampus may find interest in retaining this! And if you try out new approaches to support your child, your own hippocampus might also engage. Furthermore, if you show your best smile during all this, the emission of neuronal transmitters such as dopamine will support the common success.** (see « Neuronal growth and atrophy : The impact of priming »)

Pavlov's classical conditioning: 'pleasure by violence' through media programmes

In July 2006 the Federation of the Police Union in Germany supplied all households, via bulk mail, with information about the alarming fact that we learn through media and video games "to identify violence with pleasure" (Polizei-Basis-Gewerkschaften*). They say; "the result is a phenomenon that functions like Aids. Violence on the screen does not kill on its own, but it destroys the immune system we have against violence". For video games they explain; "Each hesitation or thought before firing a bullet is punished by penalty points. This results in the systematic destruction of the violence-inhibition threshold in the midbrain". Furthermore, they explain that the concurrence of violence on the screen while we enjoy snacks, drinks and fun on the sofa, results in the classical conditioning (Pavlov's dog) of violence being experienced as pleasure. In other words, the mere exertion of violence will ultimately lead to the light-hearted pleasure once experienced on the sofa during childhood!

The boy who ran amok at the opening of the main station in Berlin on 27th May 2006 first attracted attention to this phenomenon. The drunken 16-year-old stabbed more than 30 people. He is described as "a completely normal teenager", usually "very concentrated" (Tagesspielgel*) and with "distinctly polite manners" (Focus*). Enjoying the experience of being a "Lord, who has power over life and death, he had not intended to kill, but he had been accepting this without bad feelings" (AFP*).

Prof. Dr. Manfred Spitzer, University of Ulm, emphasizes the fact that "from a neurobiological view, children in particular can't help being spellbound by such contents" (Spitzer 2002*) because the brain is always searching for the strongest stimuli, while sifting out all other impressions (see also "The hippocampus in the age of media culture"). Furthermore, the brain of children and youngsters is constantly searching for novelties. Therefore, any prohibition automatically attracts a specific interest: as they are indicators of something unknown, prohibitions are subjected to the inquisitive drive of the brain. This means that preventing children from watching violence on TV is inevitably straining domestic bliss. Children's brains pursue these programmes with an unmatched zeal: the American Medical Association states that the average American pupil has witnessed more than 8,000 murders and more than 100,000 acts of violence on the screen by the end of primary school. This is a record no other activity bears comparison with.

While watching the screen, neuronal maps are established which control future conduct. Via the mirror neurons the impressions are replayed and trained in one's own neuronal motor areas. More and more sense-impression synapses are built. Repetition after repetition, these synapses become bigger and sustainable, while unused connections are destroyed. Inch by inch, hour after hour these functions, which at first only pertained to the screen, become the physiological reality of the neuronal network - a time bomb which needs but a detonator. The increase of homicides in the test countries was 130% only 10 years after television was introduced in these states.

Contrary to this classically conditioned loss of the sense of reality by watching violence, the physical training of martial arts teaches discipline, builds confidence and establishes a realistic judgement of the effects violence has. Martial arts training can, therefore, counteract violence. It has been shown to be efficient for reaching youngsters, especially those from under-privileged family backgrounds, who have been exposed to extensive virtual violence. The actual contact with the physical effects through challenging training provides the feedback necessary for reality-bound conduct. Furthermore, physical training promotes the emission of endorphins, thereby enhancing the learning ability. (see also chapter: How to inactivate the Stress-Modus: The bypass for the "reptile-brain')

* translation by the author

Banning children from watching TV and playing violent video games will rather increase their curiosity.	**An extensive collection of good films and a free cinema at school could be an educational resource, which may use youngsters' 'screen-addiction' as start-up capital for taking their share in society.**	**Martial arts can teach discipline and responsible conduct in cases of violence-dominated family backgrounds. It can also build confidence for those who tend to take on the role of a victim.**	**By broadcasting stories from clubs, leisure activities and initiatives with local 'heroes', the media could respond to the need for role models and for positive emotional connection within one's own environment.**

Neuronal growth and atrophy: the impact of priming

Our emotional state not only destroys neuronal cells but can, fortunately, also lead to their growth and the neuronal connectivity can be rapidly and significantly enhanced by easily applicable means. The application of either negative or positive stimuli is called 'priming'. Persisting positive priming results in growth of new neurons, negative priming has the opposite effect.

Three examples speak for themselves (Bargh 1996):

1. Students were divided into two groups and, before taking a test, were asked to put the words of certain sentences into the right order. The sentences of one group were composed of words such as tired, bad, unfriendly, ugly, etc, whereas the other group's sentences contained words like nice, happy, easy, beautiful, etc. The latter group not only scored *significantly better during the following test* (!) but walked readily and light-footedly in an obviously good physical state when taking this paper to another floor, while the participants of the other group more or less slouched with hanging heads.

2. Doctors who were given a little present such as sweets, a postcard etc. for some days when coming to work made significantly better diagnoses compared with the doctors of the control group, who received nothing (see also Fish-Philosophy).

3. Pupils who were asked to write a few sentences about how their life would be if they were a university professor scored significantly better in the following test, compared with another group, who were asked to write about how their life would be as a hooligan.

The Mexican-Hat-Effect (see "Centre-Surround-Function") can explain this phenomenon. Once you activate a neuron, it will automatically activate neurons within its immediate proximity, while at the same time inhibiting all other areas by emitting blockers. Neurons are the 'hard disc' on which any information we retain is stored in contextual maps. Once the neurons around the term "hooligan" are activated, the neuronal areas that contain more intellectual subjects will be 'switched off' by blockers and, therefore, not be sufficiently available during an intelligence test following immediately.

This also gives an explanation for the known fact that continuously complaining about someone else's particular habits makes us prone to develop the objectionable conduct ourselves. Our persistent confrontation with it makes us grow and consolidate the relevant neuronal maps in our own brain. At the same time, we are blocking other areas of our brain, which possibly contain more desirable conduct. In brief, complaining creates more and more reason for complaining. It might be recommendable to use this effect rather the other way round and to concentrate on the strong points of our human fellow beings and thereby generate a positive spiral instead of the described vicious circle.

If you criticize your fellow human beings, you will consolidate their neuronal patterns for the criticized behaviour while practising the conduct you disapprove of in your own brain.

If you verbalize the failures and weaknesses of a pupil, expressing suspicion, threats and sanctions, the pupil's 'hardware' will be out of function as soon as you walk through the door.

If you invent compliments such as "oh, this dress suits you very well!", "What a nice hair style!", "How nice to see you!", "I knew you would have the right answer!", "You will get there, I'm sure!", "Your persistence is absolutely great!" etc, the chemistry in the pupil's brain will 'take wings' by merely thinking of you when doing their homework.

A simple smile increases the inter-cortical connectivity. Advice from Vera F. Birkenbihl: "if nobody gives you a smile, lift the corners of your lips continuously for three minutes. This will emit, among other hormones, dopamine and you will feel better already (worth trying!).

Create a collective 'dopamine bank': Give each person in a group (pupils of a class, colleagues of a department, members of your family ...) a paper showing the names of all the group members and ask them to write something he or she considers to be the group members' strong and admirable point against their names. Afterwards, you may give each member the collection of the strong points they have in the opinion of the others, or you may display the names in a suitable place, each with its collection.

Threat, promise or encouragement? Contrary effects of different incentives

Threats generate the emission of neuronal blockers (glucocorticoids) via the limbic system and inhibit the neuronal functions needed for reflection (see “Panic destroys neurons”). Obviously this is most unsuitable for stimulating intellectual efforts. Where physical or routine executions are required (such as for example when applied in contexts of slavery) threat can succeed.

Promising rewards in order to encourage the child to make educational efforts is one of the most frequently used methods. However, on the neurological level, this produces a different reaction to what we expect. As an example, let us examine the neuronal aspect when a passionately desired video game is promised as a reward for achieving good school marks in mathematics. Here, the mathematics presents an obstacle to my current wish to have that game. Thus, instead of supporting my interest in maths, obtaining the desired object has the opposite effect: I do the maths with the sole intention of getting rid of it and making this obstacle disappear as soon as possible. Consequently, the relation established with the mathematics becomes hostile and therefore creates a link between the amygdale in the limbic system and the neurons corresponding to mathematics (Kohn 1993). This means that doing maths will be linked with the automatic emission of neuronal blockers and the bad relation with the unloved subjects is established on a long-term basis. The promise of an incentive has not stimulated an intrinsic pleasure to do mathematics. The stimulation of reward hormones (neuronal transmitters) has linked with the game and not with the maths.

Inherent encouragement, however, has a supporting effect: expressing recognition of, and delight in, each tiny step achieved, for each little bit understood, links the neurons corresponding to mathematics with the nucleus accumbens. This enhances intercortical connectivity by emitting neuronal transmitters, which creates good feelings as soon as mathematics is mentioned. This is why congratulating a pupil for each tiny achievement will encourage him or her to do the next step. From one achievement to the next, intrinsic motivation successively raises the emission of neuronal transmitters and spirals up the motivation, even for students with difficulties.
We can conclude that, contrary to incentives promised for a later time, stimuli during work link neuronal transmitter emission with the neurons corresponding to the required work. Therefore, for example, little chocolates and/or gentle music in the background generate dopamine and enhance intercortical connectivity and pleasure from doing the work. This is the classical conditioning of Pavlov by which, after a while, the work itself can become a dopamine stimulus.

Furthermore, a nice hint or a friendly gesture *before* starting the required work, and without conscious link with this work, is actually also a conditioning with significant positive effect (see: “Neuronal growth and atrophy: the impact of priming”)

Bribing the child by promising future rewards makes the child prone to hate the work it has to do first.	**If you put the child at ease while it does the required work, positive links with the required work will be established. Little compliments about each tiny achievement, stimuli such as chocolate or gentle music are all suitable for this. You may also reassure the child by placing a calming hand on his or her shoulder or relaxing the shoulders by a little massage.**

Day schedule and the night shift of our neurons

“Good parents” used to ask their children to do their homework first when coming home from school. But in fact it would be preferable for them to ‘rinse’ their body first from neuronal blockers, which are inevitably emitted by a usually stressful and noisy day at school. This can be done by stimulating dopamine emission through comforting and sympathetic activities such as dancing, sports, music, or, if energy for these activities is lacking, some chocolate and a funny or beautiful film, as well as showing sympathy and interest. After the brain has been conditioned by such priming, the homework will be achieved faster and better; whereas the stress provoked by violent computer games cramping the thumb muscles has, of course, the opposite effect.

Watching a film at the end of the day may again produce an undesirable effect. At night, while we sleep, the brain continuously repeats the exact patterns of the neuronal activity that took place during the last hours before going to sleep (Spitzer CD 2009). Hereby, the relevant synapses at the terminals of the axon’s dendritic branches grow, which means that what has been done or learned before going to sleep will be mastered better already when waking up.* But when watching a film is the last occupation of the day, not only will the ‘night shift’ of the neurons concentrate on the film, but what had been learned before (e.g. homework) is likely to be deleted, as the hippocampus only retains what has been neuronically most stimulating; the film, of course.

* The same applies, to a lesser degree, to the breaks during the day. Therefore, recapitulation at the end of a lesson has its effect during the following break time (if it is a real break! and emotionally more challenging than the lesson)

If you insist on homework immediately after a stressful school day, the child will actually lose time and interest.	**If you ‘rinse’ the brain first by emitting neuronal transmitters, the homework will be done more easily.** (Eat a bar of chocolate, play music at full volume and dance like mad as soon as you come home from school: this was the daily routine of my friend, who finally went to university in different countries, and languages while her 7 brothers and sisters became factory workers.)
If you watch a film after your homework before going to sleep, you will delete what has been learned before.	**If you switch on some gentle music and summarize what has been learned in the afternoon before going to sleep, you will wake up with consolidated knowledge.**

IT-TECHNICS IN THE BRAIN
PRAGMATIC AND EFFICIENT PROGRAMMING

No cognition without emotion: the "varnish" which saves input to our memory

When thinking of September 11th 2001, everybody remembers the place he or she was when hearing about the planes crashing into these buildings, whereas the events of the previous days are not remembered. This is due to the impact emotions have on the mechanisms of our memory. Science now confirms that cognition without emotion is not possible. The more a subject stimulates emotions, the better it will be retained. The more a subject at school is linked with the child's own life (his needs, fears, desires´, ideas), and the more sensorial the impressions presenting it are (an attractive lay-out, appealing colours etc.), the more sustainable the memory will be. (See also the film "Freedom Writers' Diary" American documentary.)

„Education is what remains after one has forgotten what has been learned in school." *Albert Einstein*

If you avoid examples and just give abstract extracts of principles in black and white, the child's brain will clear out what you wish him to retain.	**If you talk about experiences you have had yourself recently or during your childhood and about your personal emotions in relation to the subject, the pupils will continue talking about it. Furthermore, if you work with children on sensory impressions such as illustrations (**easy to find at Google**) for their presentations, supported by colours corresponding to the content (warm or cold, gentle or strong ones) and relevant character of the letters (fat or thin, rounded or square…), the subject will be impressed on the child's brain.** (see also "Motor activity and dexterity: gender competition or complementation")

Reprimand perpetuates the mistake

Everything we know is stored in the neuronal tissue (grey matter) in the form of an exact miniature copy composed of neurons. These copies develop while our eye scans over the subject. By giving incorrect sentences to the pupils and asking them to correct them, the pupils' eyes are forced to rest on the image of the incorrect version in order to recognize it. Once it has been recognized, the pupil crosses out or writes the right way (if known!) without resting the eye on it again once it is finished. So the trace engraved in the brain is the copy of the wrong image. Each time the corresponding word is mentioned later, this copy will automatically be activated by electrical impulses and hence appear in the consciousness of the pupil as representative of the required word!

Neuronal structures for behaviour are consolidated in the same way. Some people ask a child to write 20 times what they want the child to refrain from ("I must not …."). Each time the child hears or writes what it should NOT do, the circuits for the actual execution of this receive electrical impulses. This means that our comment inevitably programmes the execution of the probibited action. Whereas the opposite expression ("I must, I could…. I would like to ……) activates and grows the neuronal strucutres for the desired behaviour.

If you underline the mistakes in the written work of your pupils, a sustainable copy of the wrong shape will be engraved in the neuronal tissue. **By stating what should NOT be done, you trigger what you want to avoid !**	**If you write out with strong colour the right form of the relevant word (asking the pupils to copy it in order to make them look at it), the copy of this version will be reproduced in the neuronal tissue.** **If you speak about what you wish to be done or to happen, the power is sent to the appropriate circuits and its execution follows.**

Central or lateral storage? The first encounter is decisive!

Pleasant experiences are stored in the middle of the forehead in the Frontal Lobes just above the root of the nose, whilst unpleasant (strange) experiences are stored in the Temples at the sides of the forehead (Kringelbach 2005). When I hear something new without being able to connect it to anything I know, it is an irritation. So it is stored laterally in the temples as an unpleasant experience. Once stored in the neuronal tissue of the temples, it remains an unpleasant experience until I resolve to alter and reorganize it. This will need zeal, especially as the lateral storage of a difficult experience involves the emission of stress-hormones which inhibit neuronal interconnectivity and the cognitive functions.

But when introducing something new, I can also start with known elements, which allow me to enter the process confidently instead of beginning by being irritated. If I start with something I am very well familiar with, then newly added elements will have a good chance of being stored close to the neurons already active in the middle. Thus the activation of these memory cells automatically produces transmitters which support neuronal connection and learning ability.

This could be one of the reasons that explain the increasing gap between pupils whose parents instinctively find a way to deal positively with these situations when helping with homework, and those pupils having parents who resort to pressure.

If you become angry when making a mistake, you may keep repeating this mistake.	**If you take mistakes as a natural step towards perfection, welcoming them as a chance to enhance your skills, you may enjoy quick progress.**

How to inactivate the stress-modus: by-passes for the reptile brain

Approximately 10,000 bits of information per second are exchanged between people who talk to each other, but only a very small part of this has semantic character. Up to 80% is intonation and body language (facial expressions, gestures, etc.). These are empathic signals, to which the limbic system responds. The more unpleasant the character of these signals is, the more the limbic system tends to shut down functions of our consciousness until solely the fight-and-flight-modus remains.
The neuronal context of the fight-and-flight-mechanism is described in “Stress destroys neurons“: as soon as we are confronted with important challenges, the limbic system is prone to emit glucocorticoides (neuronal blockers), which impede the neocortical connections and hence access to any kind of reflection. This provides a state of purely reflex-controlled action, which in prehistoric times was essential for survival. However, when faced with challenges of modern civilisation, it is the opposite of what we need.
However, our civilisation provides facilities that enable us to by-pass this mechanism. For example, written communication such as electronic chatting and emailing eliminate this 80% of empathic information. We receive only the semantic information (words), we can openly blush without anyone noticing our reaction, and finally we are ‘head and shoulders above the others’, once we have found the right answer. No ‘crossfire’ of 8,000 ‘information-missiles’ per second between our limbic systems to put us out: we remain cool and witty. Electronic chatting is actually proved to enhance children’s intelligence.

In more complex situations, when we find ourselves with our back to the wall, needing, for example, to justify or defend ourselves, or feeling deprived of our rights etc., we don’t usually make good advocates. A person who is not affected personally and is, therefore, in full possession of his neocortical functions can be a good spokesman, able to act more advantageously in our place. We may then admire his or her clever presence of mind, while ‘sweating’ with our own glucocorticoid dose.

In order not to be totally at a loss in critical situations, it is therefore recommendable to have appropriate techniques at hand in our ‘medicine chest’:

‘Corporate Writing’: a ‘secretary’ for delicate letters or for letters of application:

Those who persistently wrestle with phrasing a letter until the small hours of the morning may easily overlook possible solutions.	**Take someone who is not personally affected by the matter into your confidence. Explain the circumstances and ask the person to draft the letter for you. In the end, you may be surprised how positively your situation is reflected.** **When teaching students how to write application letters, you may ask them to do this for each other. This makes them express mutual appreciation in writing, which is a positive side effect that strengthens the community and counteracts exclusion.**

An ‘advocate’ for difficult discussions:

Those who come under attack or are put under pressure don’t make good partners in negotiations; they are prone to make things worse for themselves and to make positions become entrenched.	**Ask a reliable person to argue in your place and be simply a listener yourself. You may discover that “less can be more” and that the ‘heavy artillery’ you intended to bring in is ultimately not needed, as a conciliatory solution may show up shortly.**

Email-correspondence instead of defending yourself on the phone

You have someone on the phone who is driving you mad (an impertinent customer, an unreliable provider, parents of your pupils who hold you responsible for the results of their own educational failures, your mother-in-law …). No prospect of mutual agreement at all. The argument escalates. Finally, you are all churned up inside and even late for your next appointment; you are in a state way off the marks… The day begins to slip through your fingers.	**Decide not to give any answers during this phone call. This keeps your glucocorticoides within limits and you keep cooler while handling the complaint. Then you simply thank them for the information, demonstrate full understanding and apologize for having another appointment right now - but assure the person that you will get back to them shortly via email.** **Now you have the time to get things into perspective, possibly to confer with someone or to seek advice. Once your neurochemistry is back in place, you may be able to choose the right words and you may even check them once again before sending the email the next day.** **Your surprisingly respectful and calm politeness will also make the glucocorticoid waves of your opponent subside. Your written attempt may therefore be met with more composure on the other side as well.**

But nothing will consolidate personality structures as efficiently as acting does. It enables you to encounter situations, to have experiences, to train specific behaviour etc. When we then come across comparable situations in life, we are already used to dealing with this, solutions are available and we can keep cool. The neuronal effect of this is that the neocortex is not flooded by an overdose of glococorticoides, which switches it off and only allows irrational reflexes. We stay connected with the thinking part of our brain, which provides maps for well-thought-out and well-aimed action. The pedagogue Hartmut von Hentig therefore states: “All we need in education are natural sciences and drama! Natural sciences make us familiar with the given facts. Drama teaches us to cope with life”. The Helene-Lange-Schule in Heidelberg runs a pioneer project titled “Acting improves your maths“ (“Theater-Spielen macht gut in Mathematik” Ewen 2006).

Roleplay: test run difficult situations first

You may leave children in front of the TV in order to have your own peace. What neuronally glues children to the screen are especially violence dominated programmes. But the mere watching of violent situations on the screen already develops neuronal maps for violent action in the motor areas of the brain: a “time bomb” waiting for its release, the effect of which is shown for example by people running amok (see chapter „Pawlow’s classical conditioning: pleasure by violence through media programmes)	**Films that show non-violent creative solutions build neuronal maps for the equivalent behaviour. To stage such situations by little theatre plays increases this effect. However, most effective is what you invent yourself. We therefore suggest a new and exciting party game: Divide the players into several groups (e.g. parents/pupils/teachers or client/seller/manager or father/mother/child etc.). For each group place some cards upside down with the description of challenging situations for this group. Each group takes one or more cards and develops corresponding solutions. The solutions are presented to all and can be evaluated by the members other groups.** **As the critical situation at that moment is only on the paper, the emission of neuronal blockers this situation would cause in real life is avoided. It is therefore possible to make full use of one’s brain and to develop ideal solutions. This promotes self esteem and peace of mind. Once a comparable situation happens in real life, the solution is already stored and can be called up. You may increase the effect if you not only read but improvise and stage the situations. This stores solutions in your motor areas as well, where they will be more easily available when you are under stress.**

However, if one day we find ourselves without any help in a totally unexpected dreadful situation which opens all the floodgates of stress hormones and we literally feel our neurons being ‘scorched’ under these doses, then, at first, the only thing that can help us is movement! We first need to ‘rinse’ our blood vessels from the corticoids (stress hormones). The most efficient way to do this is ‘to wash them down’ with endorphins, the so called “happy hormones”. We are able to produce endorphins by strong physical movement.

It is true that we also produce them when experiencing success or acquiring new abilities. But extensive stress situations inhibit the access to the neocortex, the part of the brain for learning, thinking, experiencing success, having an overview and understanding etc. (see chapter “Stress destroys neurons”). In such situations, then, the “first aid” can only come via the body movement. Once endorphins are generated in this way, the dopamine supply at the synaptic connections also increases and even destroyed neurons grow again (!) by the endorphines. In brief: the ‘detour’ via the body movement also restores our ratio.

This is the neuro-chemical process Asiatic martial arts are based on, when mental discipline is strengthened up to meditation on the basis of body discipline.

- Muscle activity generates the neuronally supporting endorphines.
- The experience of success by controlled physical movement does the same.
- Furthermore, the experience of safety or feeling unassailable reduces the emission, during critical situations, of the neuronally inhibiting stress hormones.

Thus martial arts deeply support a biochemical condition which even in critical situations allows one to keep control over one’s mental condition and to avoid moments of madness.

Worth mentioning is the fact that in all the cases known so far of people running amok in schools, the culprits were on Ritalin, which means that their motor activity was inhibited by medication. While here the endorphine supply, supporting consciousness through movement, is inhibited, at the same time the experience of the so called ‘ill’ person, lacking power and confidence, promotes the emission stress hormones, which block consciousness. In brief: the conditions for losing control are created. This is the reason why Ritalin patients are no longer accepted in the army in the United States (Department of Defence): "Freequent use of academic achievemt enhancing medication (for example Methylphenidates) is considered as unfitness. (Hathaway)

A study of the University of Ulm under the title “running makes you brighter” proves clearly the increase of cognitive (intellectual) achievement by movement. (Reinhard 2008)

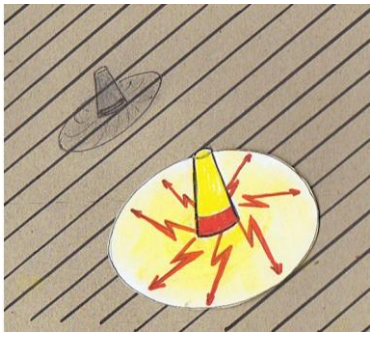
Better a „Runner’s High“ than running amok

A situation that is more than we can stand. “Acid” is poured over our brain, our legs turn to jelly and a sore, burning sensation creeps up the limbs. We lose control of ourselves and feel as though we want to either lash out in all directions or to creep away and disappear in a corner or under our duvet, etc. **… and we watch helplessly how everything only turns worse.**	**As we feel that we do not have things under control anymore and that we may be prone to do or say things we will later regret, we immediately turn round, apologize and leave the place. We may then put some music on our ears (if available) and start running immediately. We head for the next park and, depending on our physical fitness, we walk or jog for a minimum of 40 minutes – the longer the better – until our chemistry is back to normal. Then we first allow ourselves a good meal and while enjoying this, we start thinking who we could ask for advice.**

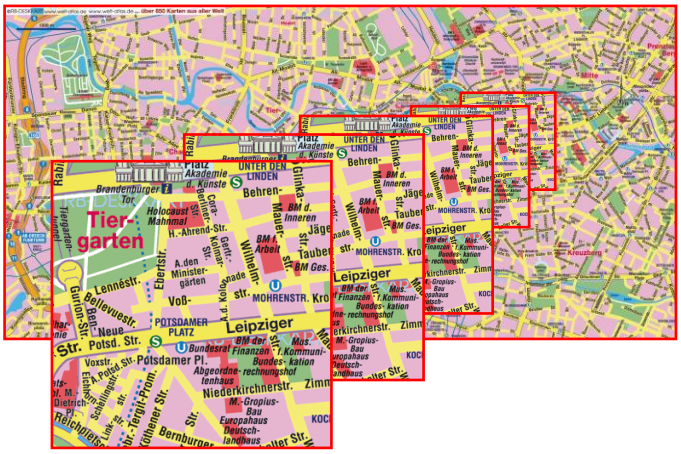
The Centre-Surround-Function or the ‘Mexican-Hat-Effect’

Start with the entirety before going into the details

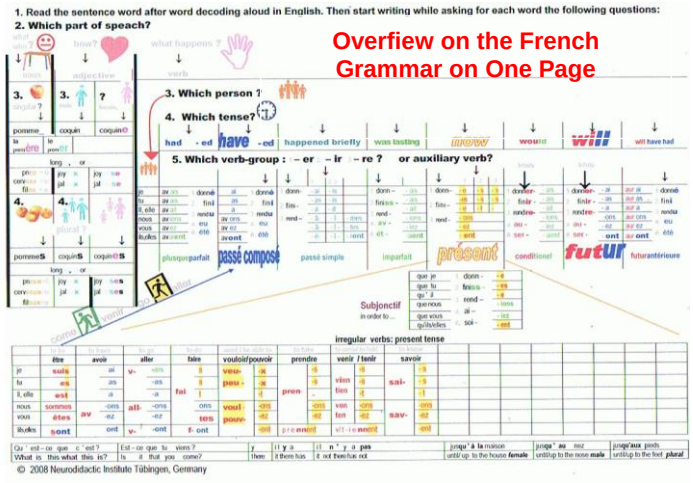
A neuron, when activated, emits electrical impulses that also activate the neurons close to it. But at the same time blockers are emitted which inhibit the more distant neurons. The content memorised by neurons within a close radius around the activated neuron (within its “Mexican Hat”) therefore come to mind automatically (e.g. ideas we call ‘obvious’), while the content of the neurons outside this Mexican hat cannot be called to mind as it is inhibited by blockers. This is the mechanism which allows us to concentrate (Spitzer 2002, 13). Nevertheless it becomes a problem when turning the pages of a book.



The way content is arranged in space (either in front of our eyes or in an imaginary space) generates a neuronal miniature copy of this arrangement on the ‘hard disc’ of our brain. For example a city-map showing the central square first in the middle of an overview-map creates the right context-scheme in the neuronal tissue. When then looking at the blown-up central square on another page, all the details seen there will be stored within the previously created context-scheme in the neuronal tissue.



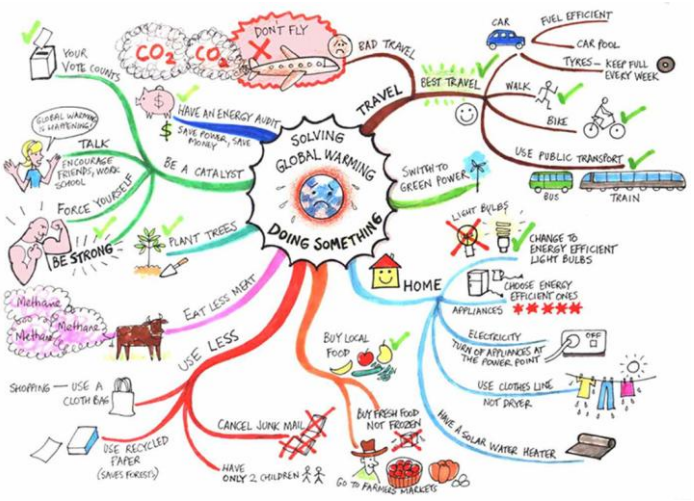
However, when turning for example the pages of a grammar book without having an overview, the eye has no reference between the content of the preceding page and the following. The latter will therefore be stored randomly. This possibly will be at a more distant place in the neuronal tissue outside the Mexican hat of the previous page. It follows that the content of these two pages is inhibited the one by the other by the blockers emitted outside the Mexican hat of each of them. This can become part of what we know as ‘black out’.



The arrangements our eyes look at while learning, therefore, determine whether the elements of any given contents will be stored closely in well organised dense neuronal maps within the Mexican hat or whether they will be scattered distantly and block each other.

Mind mapping therefore provides the conditions for storing different elements close together: if a broad scheme of ideas is examined with the pupils before going into any details, this neuronal map becomes an organizer, which will store the different elements in a well sorted and logical manner among other elements. Being thus stored closely to each other, all relevant details automatically come to mind by the natural emission of electrical impulses as soon as one element of the subject is mentioned.

This effect is reinforced by using symbols and images:
letters have no references apart from their own abstract significance; however, an image or graphical symbol is rooted by axons directly in the neuronal context of a lively representation in the brain.



How to stop Global Warming*

If you start with the details of a context, it may be difficult or even impossible to sum them up later to obtain a final general overview and the Blackout will be programmed biologically right from the beginning.

If you start with the entirety before going into the details, the automatic activation of these details in coherence with the context is programmed. Therefore: start everything with a graphical map which provides an overview (Mindmapping)!

Foreign language acquisition

'Cabling-up' or 'programming' vocabulary? The efficiency of decoding.

Visual Decoding:

Usually vocabularies are learned the following way: in the vocabulary-book we read the word in one language, which activates a neuron. Then the view turns to the side in order to read its translation, which is written ***beside*** the word. As a result of the eye movement, this translation activates a more distant neurone. Now connecting synapses (neuronal "plugs") are needed between the two neurons in order to remember this translation. But synapses only grow through continuous simultaneous use of the two neurons concerned (known as "swotting") and they disappear once the neurons are not used. Like muscles, synapses grow when used and atrophy when not used: what has been learned just before writing a school test will be forgotten rapidly as soon as the test is over.

Placing the translation now closely ***underneath*** each item of vocabulary makes both words appear in the *same* focus. This results in both of them being stored so closely in the neuronal tissue, that we do not need to maintain cables and synapses any more: both will be automatically activated simultaneously within the Mexican hat.

The advantages of placing the translation in a second line under each word of a text are:

1. Immediate mutual activation of the word and its translation in one Mexican hat
2. The eye seizes the translation in the context of the text (and not in a separate vocabulary book) and therefore the memory benefits from the emotions the text conveys.
3. As the second line does not show a grammatically correct sentence in one's own language
   - it gives a feeling for the syntax of the foreign language. And feelings are the best way of storing grammar rules. That is why we speak our mother tongue without mistake: we did not reflect on its syntax, but felt it.
   - the syntax disorder detected by the hippocampus (situated at the "reception" of the learning process) in the second line is something unknown = new. So the hippocampus will put the whole brain on alert = high reception!

whereas a grammatically perfect sentence in one's own language is recognised by the hippocampus (being the novelty detector) as "known" = "boring" and therefore the whole brain is put on 'stand by mode'.

English:	What is it?						
	What	is	this	what	this	is ?	
	Que	est	ce	que	ce	est	
French:	**Qu '**	**est**	**– ce**	**que**	**c '**	**est ?**	

English:	We should discuss this together.				
	we	should	this	together	discuss
German:	**Wir**	**sollten**	**dies**	**zusammen**	**besprechen.**

Anglais:	Why don't you buy some sweet popcorn?							
	Why	you	not	buy	not	some	popcorn	sweet ?
Français:	**Pourquoi**	**tu**	**n'**	**achète**	**pas**	**du**	**pop-corn**	**sucré ?**

If you hide the translation of vocabulary for example at the end of the book or on the back of cards etc. memorizing them becomes unnecessarily difficult and hard to achieve. **This links the hereby used neurons with the amygdale which makes that even neuronal blocker "enter the game".**	**While working on a decoded sentence (see example above) with the children, or even just one part of a sentence: First say the decoded sequence of the words in your own language, then in the foreign language. Repeat this always with the same rhythm before starting with the following group of words.**

Auditive Decoding: (it is recommended to listen to the audio data for better understanding)

Based on neurological research results AMIE4u (Active-Modern-Intercultural-Education-For-You) develops programmes fort the acquisition of foreign languages, which clearly differ from traditional approaches:

- starting point is the own language
- vocabularies appear always together with their translation (F. Birkenbihl Decoding-Method)
- music boosts the brain functions
- short-memory-sized repetition engraves tracks into the neuronal tissue
- the repetitions interrupt each other

The neurobiological processes this programme is based on are described in detail in the previous chapters. In order to understand the following description of the audio support you are invited to listen to a demonstration.

Why auditive?

Language is an acoustic experience. The aural information immediately connects the necessary, direct switching circuits. The written coding of the acoustic procedure is not only a round-about way, but it also often leads to error, in that the written text is wrongly pronounced and then later the neuronal connections must be arduously removed and replaced by connections of the correct pronunciation, which cannot then be achieved completely successfully .

Why decoded translation?

For the eye, two words written closely one underneath the other are the focus, which allows close storage within one Mexican hat. For the ear, this focus has to be a dense unit in terms of time. Therefore the native and foreign languages follow one another so quickly that the short-term memory can record them both and store them in the same Mexican hat or “Centre Surround Effect” in the neuronal tissue. This means that the expression in one language automatically activates the expression in the other language.

Why one’s native language first?

When I hear a sentence that I do not understand, it is an irritation. Then the storage takes place laterally in the temples as an unpleasant experience. Thus activation of these memory cells automatically produces stress hormones, which inhibit the neuronal connection (see chapter “Central or lateral storage”)
If I hear my mother tongue first, it is a comfortable experience, as I understand the context at once. Thus the quickly following foreign language version of the sentence is implanted in the neuronal tissue space or “Mexican hat”, which has already been prepared. This means that when I hear, in the same sentence construction, with the same rhythm and intonation, the foreign language words, then I not only understand the meaning at once, but also every word is directly stored in the already prepared neuronal tissue area. As a result, the foreign language text is immediately stored as a pleasant experience centrally in the frontal lobes. Pleasant experiences automatically produce neural-transmitters, which improve the inter-connectivity. Thus initial storage laterally in the temples and subsequent correction are obviated and the information is stored straightaway in the more efficient central neuronal memory cell tissue

Why with music?

Music immediately produces transmitters, particularly Dopamine, which increase the pleasure of the experience. As music frames every sequence (composed of translation, decoding and foreign language), it not only marks clearly when and where the next sequence begins, but also promotes (a) storage centrally in the brain and (b) the interconnectivity and memory performance. Moreover, the simultaneous increase of the music together with the triple repetition of the foreign text at the end of the sequences shifts positive feelings towards the foreign language.
Music at the end of the treatment of a word sequence aids the storage of what has been heard: during this period, the brain repeats the electrical impulses of what has been previously heard, while the music strengthens the neuronal functions.

Why is every word sequence repeated so often?

From a neuronal standpoint, learning creates synapses (interlacing connections between the nerve cells / neurones). Repeated use causes these connections to grow. It is believed that hearing something previously unknown only once leaves little or no impression. Only repetition arouses the attention of the brain sufficiently to ensure that the information is registered and not discarded as irrelevant. The brain only recognises repetitions when the first hearing is still in the short-term memory and the repetition can be recognised as identical. Thus the repetition of long text passages is futile, because the beginning has already been forgotten by the time the passage ends. This means that repetition of the whole passage is only regarded as new and strange and one is back where one began.

Why such a quick continuity?

The fact, that the sequence of translation, decoding and music threaten interruption, awakes in the brain more concentration to ensure, that nothing is missed. This activates the brain to top performance and ensures memorisation. Silent pauses, on the contrary, invite the brain to switch to standby modus.

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Translated by the author

Links

Any real life is encounter
Martin Buber

Here you will find projects, institutions and literature on neurodidactic approaches.

Once you feel inspired, get in touch.

Processes which may stagnate on a national level often find help through international contact.

We shall be grateful for further links to similar institutions and initiatives especially from other countries!

Creativity is never used up.
The more you use it, the more you get.
Maya Angelou 1928

Nursery School **Primary School** **Secondary School** **All Ages**

Didactic playgrounds for nursery schools with background information and instructions, with emphasis on movement-games including suggestions for parents and grandparents. *Csellich-Ruso* http://csellich-ruso.cayenneweb.at

Bilingual nursery schools: development of intercultural competence.

At an early age, the brain learns languages as fast and precise as it will never do later again. Common celebration of festivals of different cultural background allows not only to accept but to appreciate differences. www.gescher-ev.de;

Use another language while playing. The principle of immersion www.senftenberg.de;

Two languages – one Europe: www.grundschuleamarkonaplatz.de;

Language support for immigrating parents: Janusz Korczak Kinderhaus, Kiel;

Chinese cooking and talking: immersion into another culture: www.cleec.de

Learning by doing: scientific research corners in nursery schools. Settings, educational concepts and instructions for experiments. Bernd Schlag. Cornelsen ISBN978-3-589-24595-6 (German).

Sing and dance and conquer the world: German Songs to move and to understand life and to learn German

Rock songs about social issues such as understanding for others, tolerance, against violence, for good mood etc.: **Heiner Rusche**, www.kleine-ohrwuermer.de

Songs which help the youngest to love the world around them and learn to manage challenges: **Sonja Blattmann** www.sonja-blattmann.de

The loving heart of the youngest: Songs full of feeling and humour: **Beate Lambert**,

www.beatelambert.de

Seizing numbers with all the senses: Deal with numbers, geometrical and mathematical proportions while moving in a nursery school's domain. www.zahlenland.info

Science: discover exciting phenomenon in daily life! Research with kids in their environment. Book series **"Schau so geht das":** Fascinating experiments about light and colour, about ice and water or sound and noise, with force and balance, with sugar and salt, about climate and weather, or about breath, air and wind etc. **Velber Verlag**: www.familymedia.de/buecher
Inspiring literature for an education which uses all the senses: www.bildung-von-anfang-an.de

Sing and dance to conquer the world: German songs which make children move and help to understand the world **and to learn German.**

Movement songs (songs in which the lyrics suggest movements), videos and picture books, which speak about animals, the forest, the ocean and friends, which make walking great fun or make the fingers become the actors in a theatre. Demonstrations on the website under "Filme & Musik". **Mathias Meyer-Göllner**, www.irmimitderpauke.de

Songs with CD and picture books for movement games, finger games, games from abroad or for learning English and songs for gym or to have a good romp. **Wolfgang Hering**, www.wolfganghering-shop.de

Rock music for kids. Energetic songs which make people move. **Pelemele**, http://shop.pelemele.de

Rock songs about socialising, understanding others, tolerance, against violence and for a good mood. Texts (under „CDs", „alle Texte") and demonstrations (under „Hören und Sehen") to be seen on the website. **Heiner Rusche**, www.kleine-ohrwuermer.de

Toys: neurodidactically tested & provided for free: The ZNL Ulm (Transfer Centre for Neuroscience and Learning Univertsity Ulm) has established a system in cooperation with toy manufacturers: Until 2012 manufactures will equip all schools in Germany with toys which are qualified as neurodidactically valuable. Many schools have already arranged classrooms as "playgrounds" offering children the opportunity to follow the wide variety of activities their brain is calling for. www.spielen-macht-schule.de

Comics as school books: the biographical approach. The moving picture of a film has a suggestive effect, however, comic strips allow for readers to stop to reflect and to discuss. Their direct speech and precise situations result in personal identification with the content and link up deeply with areas of personal experience in the brain. The encounter with historical events thus becomes a process of personal maturation. Here is an example dealing with the Holocaust.
ISBN 978-3-507-11100-4, Material für Lehrer: ISBN 978-3-507-11102-8 Westermann 2010

Pupils become inventors and entrepreneurs. In project groups pupils use their technical, scientific and mathematical knowledge for the development of new technical inventions e.g. for economizing electricity or to support people with special needs (for example an ultra-sound-chip providing spatial orientation for blind people or a model of the vertebral column, which projects pressure parameters on a screen for an efficient training of osteopaths.
www.hardware-ag.de , http://www.hag-focus.de.vu

Nutrition: quality promotes concentration: "Our clever dining room" is a joint initiative of the

Nestlé Deutschland AG and the administration for school catering in the county of Hessen, Germany. All schools of the county can be awarded an annual prize for innovative concepts, plans and ideas about catering. http://www.mzfk.net/cleveres-esszimmer-wettbewerb-fuer-schulen-2010.html

Geography: experience the global village by personal contact and develop social responsibility.
"Kinderwelten" (children's worlds) wishes the principle of SHARING to become an educational issue and to support pupils in realizing international initiatives serving the Human Rights. Preventive and sustainable support, which makes pupils 'fit for life'! www.kinderwelten.com

Non-violent educational contexts: training positive conflict management by movement. As children learn most rapidly by movement, skilful body-reactions are synchronized with convincing verbal expression, offering an alternative to exclusion, insult and violence.
www.gewaltfreilernen.de

Inclusive school systems: In the Northern countries of Europe and in the German county of Schleswig-Holstein, inclusive school systems are not questioned and have already shown their efficiency.
www.alle-inklusive.de

But in spite of sufficient statistical evidence which proves that the integration of pupils with special needs is advantageous also for the other pupils, in many countries there is a lack of appropriate teacher training as well as a lack of the required means. Heinz Klippert, author of "Heterogenität im Klassenzimmer" (heterogeneity in the classroom), emphasizes the necessity of "*voluntary investigation in the future*" in order to prepare a workable field.

Art: The key for the world and for oneself. Each child will have access to artistic development: a joint initiative of the Ministry of Education, the Ministry for Family and the Integration of Women of the German county NRW and the Academy Remscheid. www.kulturellebildung.nrw.de

Circus foundation. Zappzarap provides personalized training and helps to create a circus. Age-specific programmes for kids with and without handicaps are based on a wide experience and cater to your needs. www.zappzarap.de

Gehirntraining: http://www.happy-neuron.com
Designed for people of any age, the HAPPYneuron brain fitness program minimizes the natural effects of brain aging by maximizing the brain's natural capacity to learn and its ability to adapt to new information: thousands of hours of fun and challenging brain games, adapted to your ability.