

Waldorf Journal Project #12

January 2009

AWSNA

Research into Childhood

Compiled and edited by

David Mitchell

If we knew what we were doing, it wouldn't be called research, would it?

— Albert Einstein (1879–1955)

Waldorf Journal Project #12

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RESEARCH INTO CHILDHOOD



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Gratitude is expressed to Christof Wiechert and the Pedagogical Section for allowing us to reprint these papers delivered during the World Teachers' Conference at the Goetheanum at Easter 2008.

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FOREWORD

The *Waldorf Journal Project*, sponsored by the Waldorf Curriculum Fund, brings translations of essays, magazine articles, and specialized studies from around the world to English-speaking audiences. This twelfth edition of translations has the central theme of research. The first four essays are from presentations given at the 6th World Teachers' Conference of the Pedagogical Section during Easter 2008 at the Goetheanum in Dornach, Switzerland, where more than a thousand educators from fifty-six nations met. Roughly fifty of them were from North America. This year the theme was "Educating the Will—Awakening the Spirit in the Head: Searching for New Ways."

What is meant by "awakening the spirit in the head"? James Pewtherer, Pedagogical Section Council Chair, clarifies it thus in a preparatory essay: "In virtually everything which Rudolf Steiner wrote or spoke about, he challenged his audience to look at what they thought they knew and then to take a second look at such knowledge.... He was asking them to change the way they thought ... overcome[ing] modern prejudices, right down into the way that a human being thinks, and feels, and acts. Instead of falling asleep to the unexamined biases that are so much a part of a materialistic world view that we no longer notice them, the Waldorf educator gives the child a way of learning that is a deeper mode of inquiry. Rudolf Steiner was, we might say, asking us to "awaken the spirit of the head."

Each afternoon a research specialist made a presentation. The first article in this collection is by Dirk Cysarz who presented a range of research outcomes on the subject of sleep and learning. Working groups involved in the study (including the Harvard Medical School and the University of Lübeck in Germany) have conclusively shown the importance of sleep for learning—the experiences from the day are transferred from the short-term memory in the hippocampus to the neocortex.

This is followed by an article by Günter Haffelder on novel methods of researching learning. His institute has developed a therapy using "neuroactive music" that stimulates underdeveloped brain frequencies. For example, the concert note A originally had a value of 432 Hz, which is closely related to many body rhythms; nowadays the note A is adjusted to a frequency of 440 Hz. In Mozart's day there were no metronomes and the music was probably played half as fast as it is today. Today such music is played in comparison at a hectic pace, leading to orchestra musicians experiencing high stress levels.

Neuroactive music, which replicates a frequency of 432 Hz shows remarkable effects. Even after one minute of listening to neuroactive music,

the reading skills of a dyslexic person are improved from two to six lines a minute. In another case a traumatized girl whose mental development was estimated as equivalent to that of a three-year-old was able to move in the course of a year from a special school for handicapped children to a normal school. Haffelder's institute has carried out projects in a number of schools. Another problem Haffelder addressed was the use of the drug Ritalin. About 10% of all children are prescribed with Ritalin, partly because their parents find them nervous. Even a single treatment with Ritalin can lead to a disconnect between the frontal lobes and the rest of the brain. Sense impressions can no longer be perceived by the part of the brain that most reflects our human nature. Children thus start to lose their individuality, whilst on the other hand the amygdala is starved of certain hormones, leading the children to become depressed or aggressive.

Christian Rittelmeyer follows with a treatise on the advantages and disadvantages of brain research for pedagogy. His research shows that bodily activity and emotions are important for learning processes in the brain. Learning primarily for a test, brain jogging, and other similar activities lead to shallow learning processes that are not sustainable. Rather, many sensory experiences are necessary aspects to effective learning processes and brain formation, such as joy, disappointment, and astonishment.

Finally, Maximilian Moser reports on various aspects of biorhythm research in his article, "The Symphony of Life." Neurological studies amplify that profound levels of learning can occur only if the learner is interested in the subject and when the whole person is involved, most especially the feelings. Thus modern research confirms what Rudolf Steiner said nearly a hundred years ago.

In the United States there have been many comments recently on neurological findings that support the methods used in Waldorf education; David Mitchell presents a few of these insights. From Brazil we have another study on Waldorf graduates in which the authors confront the seven myths about social participation of Waldorf graduates. The concluding article is in the same vein—a recent study of Waldorf graduates from Denmark.

We hope that you will be both informed and inspired by these writings. All the articles are available on-line at

<http://www.waldorflibrary.org>

For those not interested in downloading the material, inexpensive spiral bound copies are available from AWSNA Publications

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The editor is interested in receiving your comments on the articles selected. We would also be interested in hearing what areas you would like to see represented in future *Waldorf Journal Projects*. If you know of specific articles that you would like to see translated, please contact the editor.

RHYTHMS AND THE LEARNING PROCESS

by
Dirk Cysarz

translated by
Stefi Castri

What Exactly Is a Rhythm?¹

We might be inclined to define rhythmical phenomena as periodically oscillatory processes. A moment's thought, though, proves this statement to be incomplete. Taking the natural pattern of the course of the sun, for example, we could surely define it as a periodical feature that brings us day and night, but at the same time it is characterized by its fixed itinerary in the sky. Its position is predictable and no major deflection from physical laws is ever likely to occur. By the same token, many processes in our technical world imply a periodicity—such as clocks and turn signals on cars—but, again, they follow a standard sequence that can be correlated to physical laws. These periodical processes are fixed; no mutation is possible. And rightly so. If a clock were not accurate, it would be of little value, and if the sun were to cease following its fixed course, we would quickly recognize that the world was “out of joint.”

These simple examples show that the notion of “rhythm” is not adequately defined within the inorganic or inanimate world. The organic, animate world is different; here the essential can be shown by such rhythms as heart rate and breathing rate. Careful observation of both rhythmical functions shows that these are not fixed. In a healthy being, no heartbeat ever totally replicates another. Breathing is also flexible. Both functions adapt in order to meet successfully the numerous requirements of everyday life. When climbing stairs, heart rate and breathing rate accelerate. In a subsequent moment of physical rest, heart rate and breathing slow again. This flexibility, made possible by the rhythmic nature of the process, is typical of a healthy human being.

A steadier, less flexible heart rate is also possible. This is not common in a healthy being, but rather is a consequence of an illness such as a heart attack. It is difficult to determine the consequences of a fixed breathing rate—there would be little possibility of speech or eating; both activities

1. This article was delivered as a lecture at the World Teachers' Conference in Dornach, Switzerland, on March 17, 2008, and is printed with permission.

influence breathing rhythm. Briefly, in animate nature, the loss of rhythm brings considerable difficulties and consequences. A fixed rhythm denotes a pathological condition, a decided restriction of possibilities. On the other hand, it is true that rhythms do not occur completely at random. Should the heart, for instance, lose its rhythm due to partial motionlessness — arrhythmia — a pathological condition is manifest. In this case, a “pacemaker” will restore certain vital margins of rhythm.

Based on these two descriptions of the loss of rhythm — one too regular, the other too chaotic — it is now possible to define rhythm more precisely. The rhythm of a healthy heartbeat ranges between the following two extremes: the fixed rhythm, which can also be defined as a meter at fixed intervals (and which is present in the inanimate world), and motionlessness that no longer represents rhythm as such. The margin between the two extremes can be fairly wide, and rhythm thus finds ample scope. Bearing these considerations in mind, it is readily understood why rhythm can be defined in the abstract as “a chronological repetition of similar (timed) structures.” Rhythm contains aspects of the past within itself — something that has once occurred is repeated. Rhythm also allows for an aspect of the future, as the precedent feature is not stiffly repeated. Rhythm can undergo variation, offering innovation. This mutation is intended within a precise framework, however, or it would happen randomly. Rhythm unites both past and future. This combination is continually refreshed, not becoming obsolete and not running ahead of time. It takes place in the present.

Another attribute of rhythm is mediation of opposite, extreme conditions. In the heartbeat, for instance, two incompatible conditions are found: systole, during which the muscle of the heart contracts; and diastole, during which the same muscle relaxes. Rhythm is the mediating, linking element between these two conditions. In the same way, past and future are irreconcilable; only rhythm itself successfully links one to the other.

Rhythms in Childhood and Adolescence

What do the foregoing statements about rhythm imply for development in childhood and adolescence? In a recent survey, we analyzed the development through childhood and adolescence of the rhythm of the heartbeat. Our research shows that the average heart rate decreases until around ten years old (Fig. 1). We found that the heart rate in toddlers averages 110 beats per minute and at the age of ten only 90 beats per minute. The rhythm of the heartbeat also changes. In toddlers we find a rather fixed rhythm; rhythmical margins are narrowed by increased heart rate. From around age ten onward, the quality of the rhythm of the heartbeat reaches features comparable to those of an adult.

Another significant human rhythm is circadian rhythm. Different studies have confirmed subjective impressions. Some people prefer to get up early in the morning (so-called “early birds” or “larks”). Conforming to their predisposition, these people are more productive early in the day, feel tired

relatively early at night, and tend to go to bed early. Their MSF (“midpoint of sleep on free days”) occurs earlier in the night (Fig. 2).

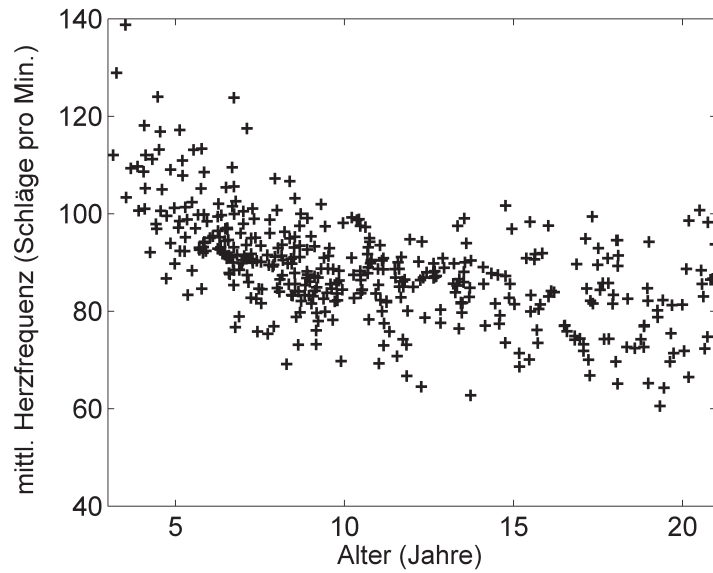


Fig. 1. Average heart rate through childhood and adolescence. Heart rate distinctly decreases until around age 10, then remains constant. (Data by Cysarz and Seifert, publication forthcoming.)

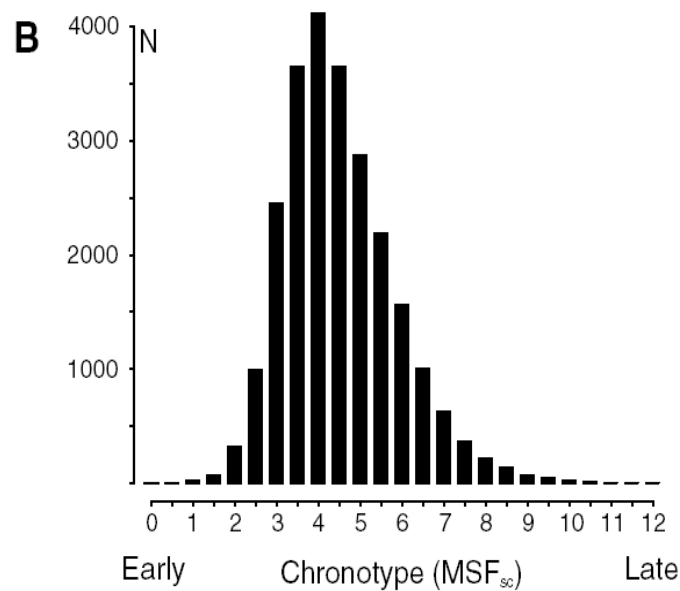


Fig. 2. Distribution of chronotypes (MSF_{sc} , corrected mid-sleep time on free days) from database of approx. 25,000 people (see Roenneberg 2004). The “larks” occupy the earlier tail and the “owls” the later one.

Other people prefer to sleep in. Their productive phase occurs rather late in the evening (so-called “night owls”). There are many nuances between

these two extremes and the average person's sleep need occurs between them. Roenneberg's assessment of the distribution of different circadian rhythms in a group of approximately 25,000 subjects shows that the subjective attribution of "owls" and "larks" is not constant; it alters during the lifespan.² In childhood we find a strong tendency toward the "larks." The "larks" gradually become "owls" through about the age of twenty; that is, through childhood and adolescence, the pendulum swings from one side to the other. This result conforms to the subjective experience of parents. Young children tend to prefer to get up early and they tend to have early bedtimes. The older they grow, the less sleep they need and, consequently, bedtime is generally delayed. Adolescents start to sleep longer hours and no longer want to get up early. During adolescence, nights can sometimes turn into days, postponing bedtime. Perhaps surprisingly, around the age of twenty the pendulum starts to swing slowly back again. Over the next decades of life, we wend our way back to the "lark." The authors of the survey associate this change of tendency with the end of adolescence. Although initially not linked to precise biological functions, some criteria (beyond the scope of this paper) are beginning to emerge. Another remarkable feature of this turning point is the distinct difference between genders. Men tend much more to be "owls" than women. This difference subsides only at around the age of forty.

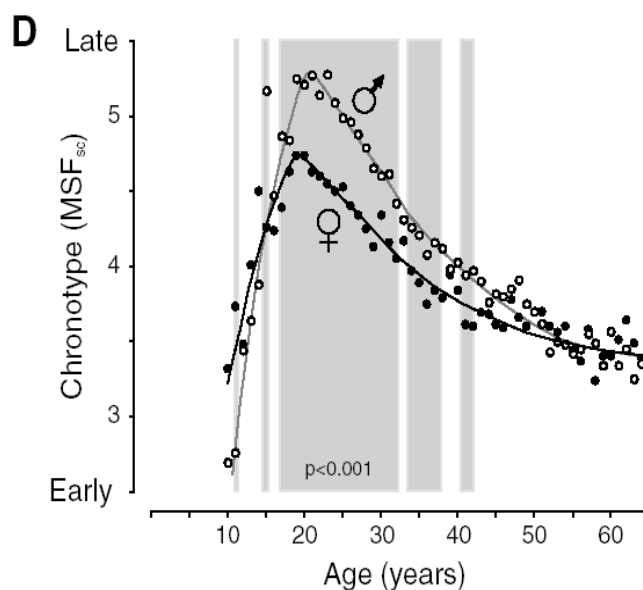


Fig. 3. "Mid-sleep time on free days" (MSF_{sc} , corrected mid-sleep time on free days) changes considerably during a lifetime. In childhood and adolescence the change from early night to late night is evident. Note the inflection around age twenty; those older than twenty begin to prefer an earlier bedtime again. Note, too, how the trends differ with gender (see Roenneberg 2004).

If we compare the transition from "lark" to "owl" through childhood and adolescence with the development of average heart rate, it becomes clear that both functions differ in their progress. Heart rate is basically invariable

2. Roenneberg, et al., 2004.

from ten years old onward, whereas the circadian rhythm, including sleep habits, undergoes major changes in the years to follow. One may infer that these two functions have different implications for general development. The rhythm of the heart is fully developed by around age ten, thus permitting the development of other capacities—the ability to love, for example, which is biologically manifested by puberty. Adolescents can rely on already-developed heart features and concentrate on unfolding further capabilities, which then manifest themselves in circadian rhythms.

The Circadian Rhythm and the Learning Process

The past decades have seen a remarkable number of studies regarding the relationship between learning and sleep. Many of these studies establish the relevance of sleep for the learning process. A significant number of these studies have been carried out at Harvard Medical School and at Lübeck University.

The American authors Stickgold, Walker, and their colleagues study primarily the performance of motor skills when awake and during sleep.³ In one study, subjects were asked to complete short finger-tapping tasks on a computer keyboard. The number of completed sequences and the errors were timed. The use of the computer allowed the measurement of intervals between the tapping of keys. This experiment was repeated a few times during one day, at the end of which the subjects were allowed to have a night's sleep before being asked to perform the finger-tapping task again the next morning. The fact that the keystroke transition speed moderately increased during the day caused little surprise (see Fig. 4a). The number of sequences per training session rose slightly. The distinct, large augmentation of sequences after a night's rest, however, was astounding. Further practice following sleep showed only a "normal" increase, that is, the normally expected improvement in performance during the day (see Fig. 4b). Another surprising finding was that those keystroke transitions that had been difficult on the first day became clearly easier to perform following sleep. By contrast, these same transitions could not be improved during one day (see Fig. 5). Sleep, therefore, manifestly enhances those motor skills that affect both speed and fluency of movement. Although this study was carried out on a computer keyboard, it is evident that other motor tasks, like practicing a musical instrument, for example, follow the same principle.

An obvious next step was to ascertain to what extent a daytime nap influenced the learning of motor skills. Here again extraordinary results came to light. A midday nap also yields enhanced motor performance, albeit less than a night's rest (see Fig. 6). When both groups (subjects who did or did not nap) were tested again the next day, following a full night of sleep, those subjects who had napped showed only a slight additional increase in performance speed. Those who had not napped (who had had only a night's sleep), however, showed a more significant increase in performance speed.

3. See Walker 2006.

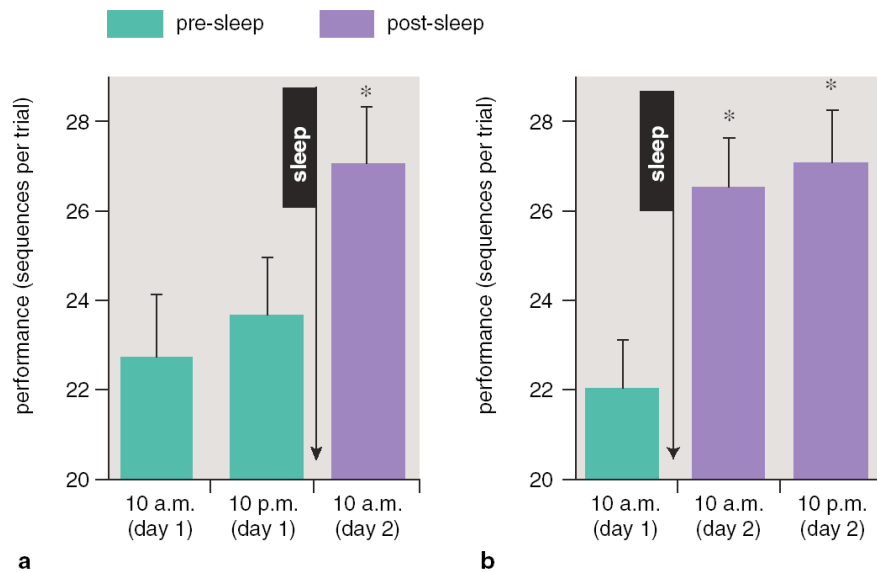


Fig. 4. Number of sequences on keyboard per trial. (a) Two trial sequences on day 1, two trial sequences on day 2. Sleep between day 1 and day 2 distinctly increases the number of sequences (see Walker 2006).

Total daily improvement for both groups (nap and sleep or sleep only) was approximately the same. These data suggest that there is a relatively fixed limit to performance enhancement in a 24-hour period. Even when one extends the period of sleep by repeated napping during the day, for example, it is not possible to exceed the daily limit on improvement. One conclusion to be drawn from these studies is that real, cumulative learning requires several sleep-wake cycles to be assimilated effectively. One 24-hour period is not enough.

Among others, an important study on the significance of sleep in learning to perform cognitive tasks was conducted by the endocrinologist J. Born and his team.⁴ Subjects participating in this experiment were asked to transform a given string of digits into a new sequence following a fixed scheme (see Fig. 7). Each string was composed of the digits 1, 4, and 9. Subjects had to follow two rules. The first was the “same rule” (for example, 1 and 1 results in 1). The second was the “different rule” (for example, 1 and 4 results in the remaining digit, 9). Initially, the first two digits of the string are transformed, and the next digit is processed with the preceding result. After the final transformation in the string, the last digit is entered as a result. This procedure allowed measurement of the time that elapsed between the presentation of the transformation task and the first result. The relatively long procedure (duration: approximately 9 seconds) could be significantly reduced by adopting a trick that was not revealed to participants. The final result of the previous transformation permitted subjects to recognize a shortcut that would save them considerable time (approximately 2 seconds). Because the shortcut led to the final result much faster, it was easy to discern those subjects who

4. See Wagner 2004.

had discovered the trick. How many subjects detected the shortcut? After practicing three times, more than 20% reached the solution (see Fig. 8, left bar). These subjects were then excluded from further study.

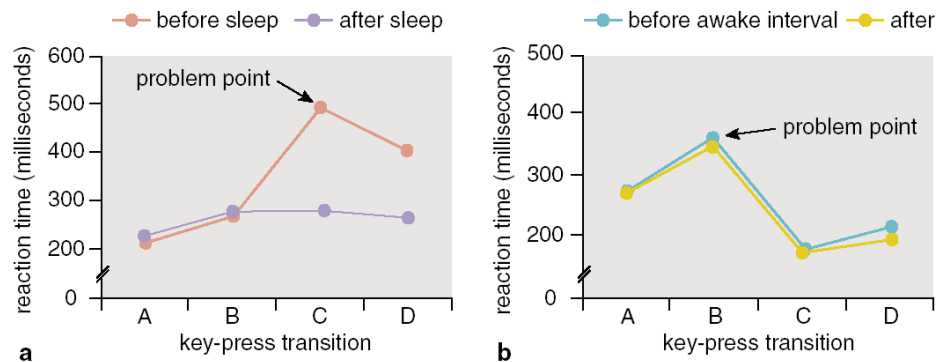


Fig. 5. Timed keystroke transition at problem points. (a) When practicing before sleep the problem point is evident as the reaction time is longer between tapping of the two keys. After sleep this problem point disappears. (b) Different keystroke transition; during a day without sleep, there is no improvement (see Walker 2006).

The remaining participants were divided into two groups: The subjects in one group were allowed to sleep the following night, and the subjects in the other group had to stay awake. Surprisingly, almost 60% of those who had a night's rest were able to discover the shortcut the following day (see Fig. 8, middle bar). Only 20% of those who had not slept discovered the shortcut (see Fig. 8, second bar from the left). Factors that might have affected the extraordinary increase in the group that had rested were excluded by using questionnaires (for example, had subjects dreamt of a solution?) and by testing additional groups to discover, for example, the possible influences of morning or evening trials (see Fig. 8, hatched bars). These results clearly show the influence of sleep on cognitive performance. The conditions of the study are artificial, but their import for the acquisition of other, real-life cognitive skills (learning mathematical rules, for example) is highly plausible.

The studies mentioned so far involve adults only, so to what extent can these findings be transferred to children and adolescents? Some first studies are beginning to show results that demonstrate similar phenomena for the young.⁵ In one study, children had to learn correctly at least half of given pairs of words. This procedure was performed with two groups at different times of the day: just before bedtime and in the morning. In both groups, at different points in the day, knowledge of the pairs of words was tested. The children belonging to the group that had been allowed to sleep right after studying, when tested the morning after their night's sleep, were able to remember three pairs more than they had the evening before. This result did not change when tested a second time on the same day. When the pairs of words were studied in the morning, the children were able to memorize a new pair by the

5. Backhaus 2008.

evening and to remember a set of two pairs the next morning after a night's rest. Studying just before going to bed yielded the best learning results.

These findings lead to the conclusion that what was discovered to be valid for adults is likely also valid for children and adolescents. The conclusion for all groups is the same: Sleep considerably enhances both motor and cognitive learning performance.

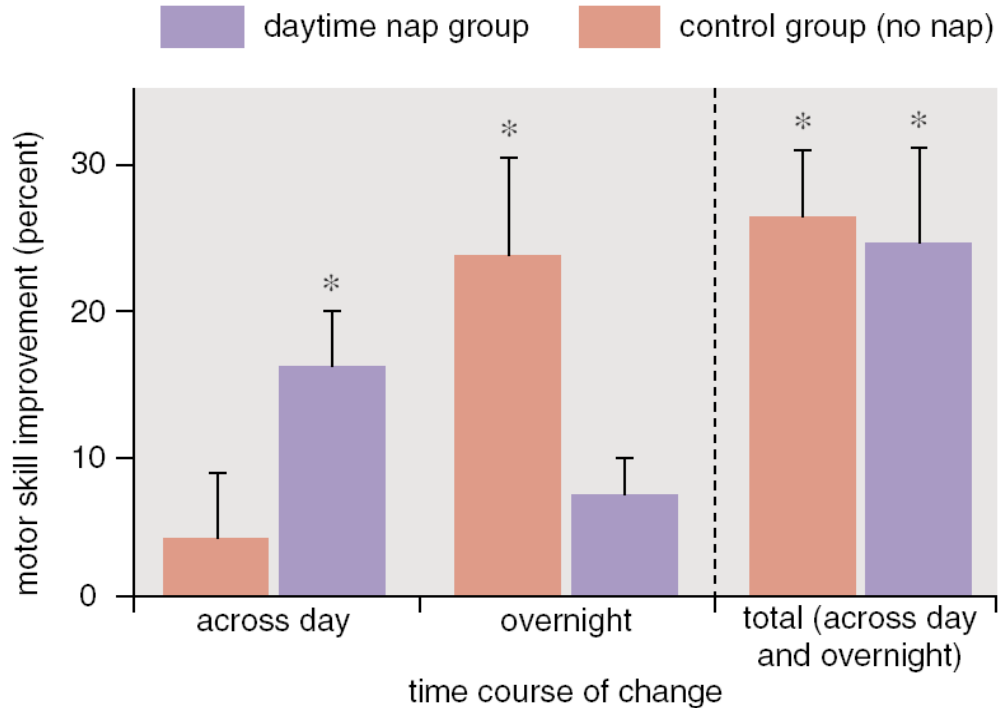


Fig. 6. Memory enhancement due to daytime naps. Taking a nap (right bar of each pair) shows improved motor skills compared to no napping (left bar of each pair). With a nap, however, the enhancement during the subsequent night is less (middle pair of bars), so that in both groups the increment is comparable after sleep (pair of bars on right) (see Walker 2006).

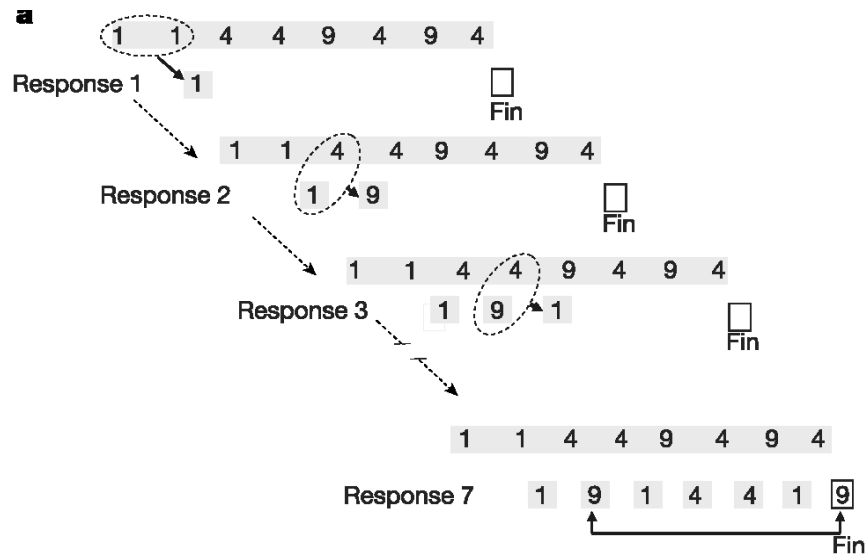


Fig. 7. Sequence of the transformation of a string of 8 digits into a new string according to rules outlined in text. The result of the last transformation appears as the second step within the sequence of transformation (see Gais 2004).

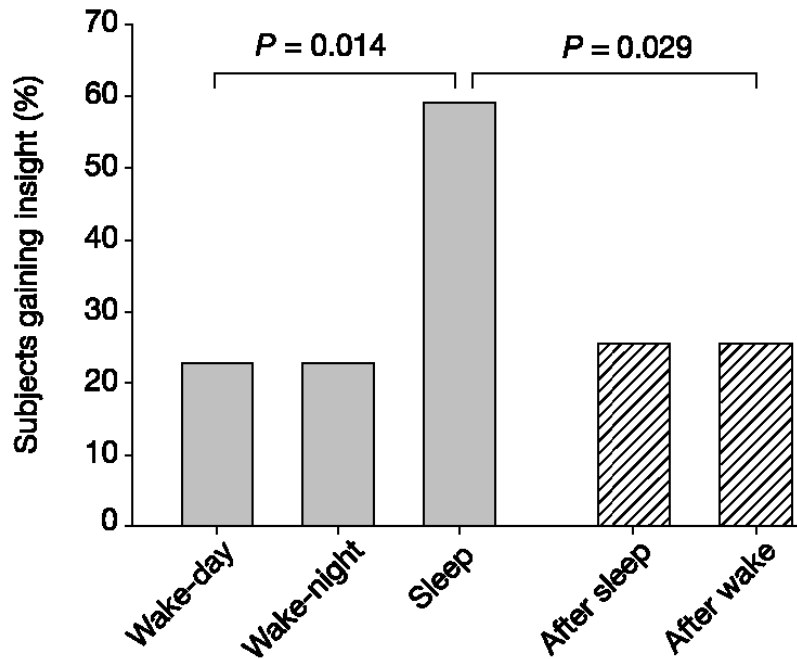


Fig. 8. Number of subjects who recognized the shortcut to obtain result. After 3 rehearsals, 20% of subjects recognized the shortcut (left-most bar); after a night without sleep, 20% again recognized the shortcut (2nd bar from left); but a night's sleep enhanced performance dramatically (almost 60%, middle bar). In order to analyze the influence on results of different times of the day (morning/evening), 2 groups were examined. In both cases the results are approximately 25% (hatched bar) (see Gais 2004).

Learning Conditions

Clearly, sleep is an exceptional learning aid. (We may even be tempted to infer that a lot of sleep is beneficial to learning, but this is not necessarily so. Again, studies demonstrating this are beyond the scope of this paper.) The starting point for each of the studies included here was the subjects' first attempt at the task. Studies demonstrated that repeated practice, at intervals of a few hours, led to minor but constant improvement of motor skills. On the other hand, engaging intensively with the assignment did not lead to immediate improvement of cognitive skills. In both cases, however, intensive engagement with motor and cognitive challenges formed the basis for what is then carried into sleep. No subjects, however, awoke from their sleep able to master immediately the tasks of the previous day. An essential point here is that the task had to be resumed before it was possible to register a significant improvement. Given these results, we can formulate the following conditions for a learning process that includes sleep:

1. Initial practice of a motor or cognitive skill;
2. Sleep;
3. Resumption and practice of the skill.

Thus sequenced, it becomes apparent that the learning process has its own rhythm, one that builds on the circadian rhythm. Each of these three conditions may be further divided and treated as a rhythmic process involving practice and rehearsal followed by rest. We know, too, that sleep itself is a rhythmically structured process (see Fig. 9). Learning, then, clearly involves rhythmic processes that occur in different time scales.

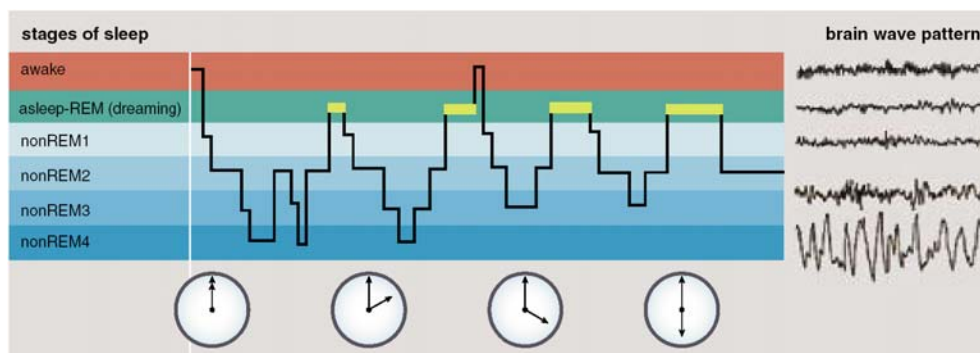


Fig. 9. An ordinary night's sleep is divided into different phases and shows a rhythmical structure. Toward the end of sleep the depth of sleep diminishes and the number of REM-phases increases. (REM is "rapid eye movement"; non REM4 is deep sleep with no eye movement) (see Walker 2004).

Conclusion

Sound sleep is essential to wellbeing and regeneration, and sleep also sustains learning processes, especially, as we have seen here, for motor and cognitive skills. Educational concepts, of course, must take into account various time scales, from the very small—within a class hour, for example—to the very large, even vast—the lifespan. Further, we should bear in mind that the effect of sleep on the learning process for one day is limited. The learning objectives we set must be realistic for the children and adolescents whom we teach. Finally, we should acknowledge that the phrase, “I need to sleep on it,” is not empty procrastination, but a valid truth for human learning processes and, therefore, for education.

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NOVEL METHODS OF RESEARCHING LEARNING

by

Günter Haffelder

translated by Peggy Elliott

Abstract

The brain is for one's entire life capable of plastically reorganizing (i.e. building and rebuilding new neuronal nets). This dynamic process of reorganization is steered by activities. Through this, our brain is capable of learning lifelong. The 'Institut für Kommunikation und Gehirnforschung in Stuttgart has developed methods to enhance this learning capability of the brain, by opening new learning windows outside of the so-called sensitive periods. Thus, learning disorders can be overcome and learning can be intensified and accelerated in all phases of life. For that purpose, a neuroactive individual music is produced on the basis of a standardized EEG spectral analysis measurement. This CD is then listened to during learning.

Development and Learning

The functioning of the brain is determined in a multifaceted way by its development. Environmental factors, conditions of life, and relationships have an effect on the child and control the building of the brain structure by the experiences made. For this reason, each brain is unique, and its structure and function can be understood only when regarding it from its individual development. The physical maturation processes which are the basis of this structure building can, however, be more or less successful according to the conditions of life and the influences to be assimilated.

A pregnant woman initiates with her swaying way of walking the endogenous rhythmic of the baby's brain. A stressed mother who is going to work creates other conditions for this development than a mother with a peaceful mind going for a walk, or a woman who is subjected to disco noise, or to the bumping and clattering of long car rides. Disturbances of these basic rhythms at an early stage can have diverse consequences. Many learning disorders and problems of concentration may arise later and can be seen as disturbances in the rhythm of the brain.

During the development process of the child alternating reflexes appear. These cascades of reflexes can be interrupted by traumatic incidents during

pregnancy or during birth. Disturbances in the course of these reflexes will later superimpose or block other structures, and will be present throughout the whole development process as chronic disturbance patterns, and may sometimes be maintained lifelong.

Manifold movements, the unrestricted ability for motor learning, the mastery of different movement processes, and the availability of brain-owned movement programs are indispensable for learning and development. Particularly during the maturation period after birth, our brain needs intensive and manifold movement impulses. During the crawling stage, the networking of the two hemispheres is initiated and, at the same time, the capability to think three-dimensionally. According to the intensity of the crawling stage, both hemispheres are networked differently. Thus, the basis for differences in lateralization is created. A lack of networking between the two hemispheres can lead to learning disorders as the lateralization processes are not only responsible for the later space-time orientation, but also for the building of speech and writing.

The development of the frontal brain is not yet finished until the age of twenty-one. Therefore, as an educator and a person to whom the child relates, we have to provide an example and be a partner in the exchange of ideas in order to shape the behavior patterns for orientation, and to impart values and norms. We should not surrender the adolescents to their peer groups and therewith accept and tolerate the adoption of the values of those. All education processes are arduous and are vehemently demanded by our adolescents through their provocations. As we are responsible for them, they merit our endeavors.

The most important influencing factor which enables us to learn at each stage of life and everywhere are the emotions which are stored in the limbic system as experiences made with relations, liaisons and safety. Children with a reliable bond and who have had experiences with intensive loving relations are able to approach new experiences and new learning processes with curiosity and joy.

Learning can be successful only in interaction with emotions.

All these processes must be passed in certain sensitive phases and can lead to good conditions for learning and development or, in an unsuccessful maturation, produce problems for the future of the child, hindering him/her in learning for school.

Well trained and experienced teachers and educators can see in their daily working world the whole range of individual development and the chances and possibilities. However, they also see the learning disorders, blockades, development problems and difficulties of their pupils through their loving observation of the children and their professionally trained perception.

They have developed a diversity of programs for learning, musical instruction, and early rhythmic fostering in order to support the development

of the children. Yet, they often speak of their lack of knowledge of certain stages of development, their stress in everyday work, their feelings of helplessness, of not being able to do justice equally to all children, and their being left alone with the problems which arise from our social developments.

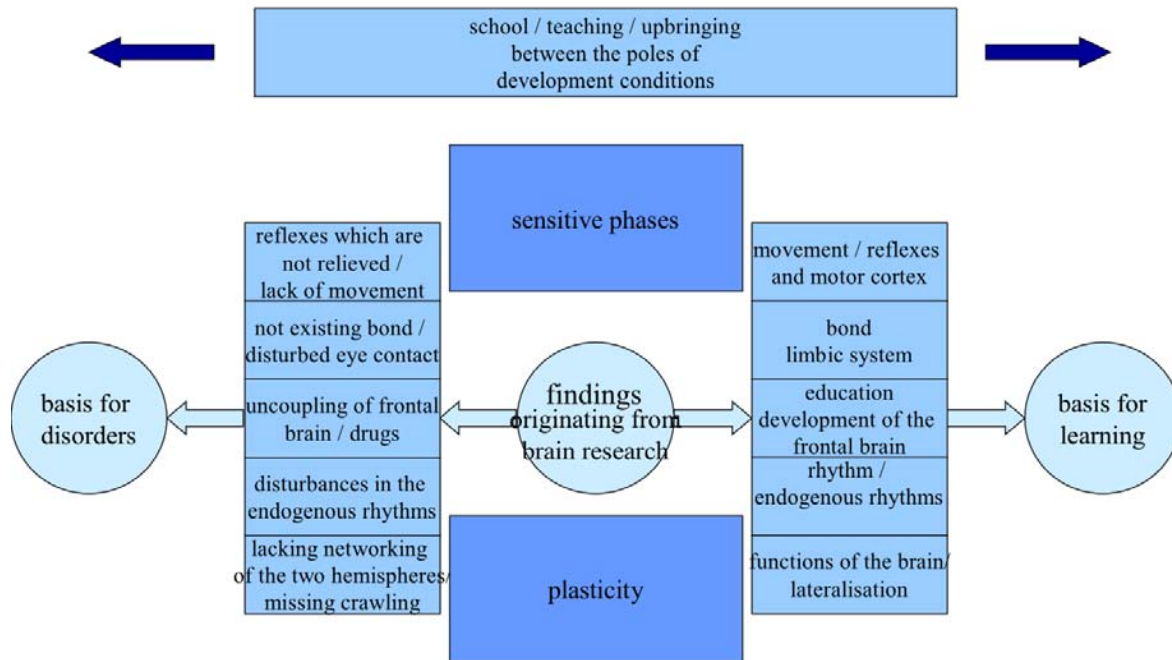


Fig.1: Maturation processes in the brain's structure building

We have to see our children as representatives of the symptoms of our age, and we must learn to understand them. The child's brain will, in its use-dependent plasticity, be built exactly into the brain which is required by its environment, on the basis of the corresponding life conditions, inputs and stimuli, and which its experiences allow. The development of the brain and its functional capacity is determined by many overlapping steps. Missed development steps can barely be compensated for with common pedagogical concepts. Besides the responsibility for minimizing damages in the development by preventive measures, it is necessary to give well directed support when difficulties, developmental delays and problems appear. This can be done by measures that accelerate learning and therapies.

Against this background, the work of the Stuttgart Institut für Kommunikation und Gehirnforschung is to be seen. By means of a special "EEG spectral analysis measurement," the causes of learning and developmental disorders can be diagnosed, and the individual can be supported specifically by a special neuroactive music, which is tailor-made on the basis of the measurement. By listening to this music, the plasticity

of the brain will be stimulated, new learning windows will be opened, and the brain increases its ability to reconstruct necessary processes in order to facilitate and intensify further development and processes of change. In addition, if there are no special problems, this method can be applied for optimizing learning and making it more efficient, and thus it is also applied in cases of cerebral damage.

The Measurement Method for the Diagnosis of Learning Disorders

The main objective of the research work of the Stuttgart Institut für Kommunikation und Gehirnforschung is to causally take measures against learning disorders in children. For this reason, an “EEG spectral analysis after the method by Haffelder” has been developed. With the aid of the Fourier Transformation, the frequencies that are customarily measured for medical purposes are split into their constituent components and plotted in the form of spectra separately for both hemispheres. This method has proved to be very significant and is empirically ensured by a standardized test method. In this way, a precise interpretation of the audibly evoked potentials is possible, enabling differentiated statements by the exact temporal assignment to the asked questions. Thus, research into specific topics is possible, for example an investigation of the causes of learning disorders, or the effect of specific stimuli on brain activities.

All measurements are individually different as they show the learned patterns, experiences, structures, ways of assimilating, as well as the emotions of the individual. A special electrode configuration enables the measurements to be free of movement artifacts, so that movements, conversations, interactions, and learning processes can also be investigated. Children can now be measured while solving problems, while reading or writing, and while doing motor exercises. The factors that hinder the learning processes can be seen in the resulting diagrams.

Since this measurement method supplies data for a longer period of time without interruption, unlike other imaging systems, it enables one to make statements on working processes, their blockages, and the possibilities for making learning more effective. With the new position of the electrodes, subcortical signals in the region of the limbic system and the frontal cortex are recorded. Thus, another significance is attached to some potentials of the different frequency ranges, particularly with regard to the modified interpretation of the delta waves.

Activities in this frequency range are correlated with nonverbal human communication and intuitive perception processes in interactions. The Institute received impressive results in its research concerning the interactions between teacher-pupil, doctor-patient, and therapist-client, results that emphasize the importance of building relationships. A loving, empathetic interaction, a relationship that is borne by mutual respect, estimation and acceptance, and a confident and reliable attachment, are the prerequisites for each learning process.

The graphic representation in form of a chronospectrogram facilitates the whole depiction of the data during a long measurement period. On the basis of the empirical research work of the Institute, indications of functional disturbances as well as of efficient processing can be received by the comparison of the chronospectrograms. Learning disorders are no longer defined as certain fixed deficits, but as a concept of the brain for finding a solution to the diverse disturbances. These are to be recognized and solved. Then, owing to its plasticity, the brain will be in a position to build new and more efficient processing patterns. Both processes are stimulated, supported and accelerated by the neuroactive CD.

Causes of Learning Disorders

In the Stuttgart Institut für Kommunikation und Gehirnforschung, thousands of pupils of different school types and of different ages have been measured. From this broad range of findings on learning, learning disorders, and conditions for the adequate structuring of learning processes, four diagrams will be described in this article to illustrate different disturbance patterns with different causes, thus providing a first insight into the diagnosis that is the basis for the work of the Institute.

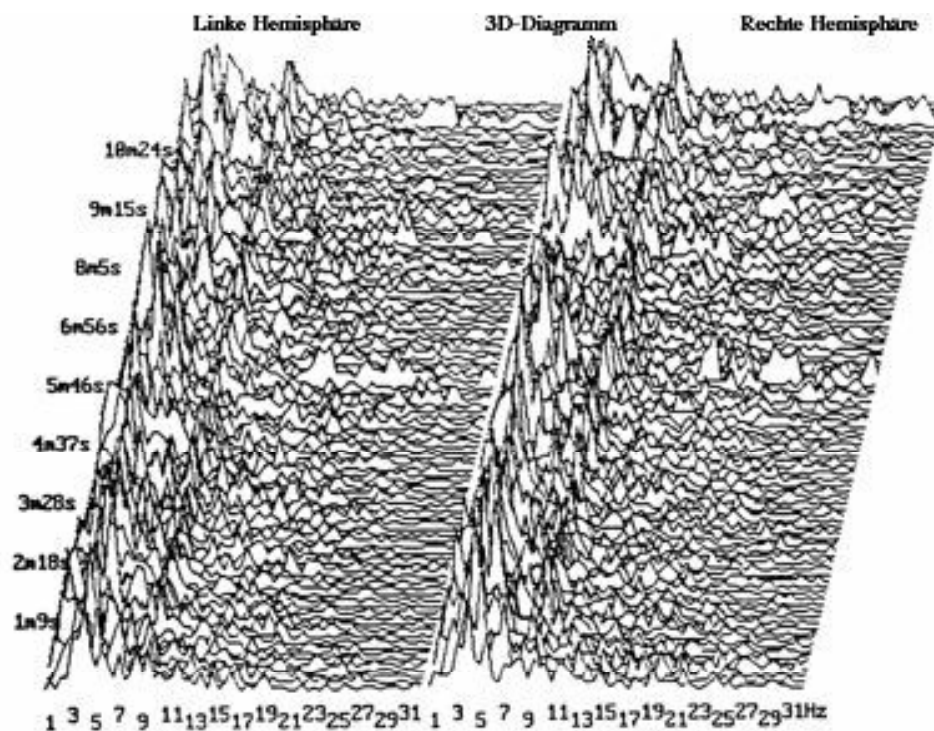


Fig. 2: Emotional problems in the context of a particular question

Figure 2: The whole measurement shows that this child is very sensitive and his reactions very complex. When he is asked questions concerning his family situation (10 seconds to 3 minutes, 30 seconds), the diagram shows strong emotional stress, which indicates a burden concerning his domestic environment.

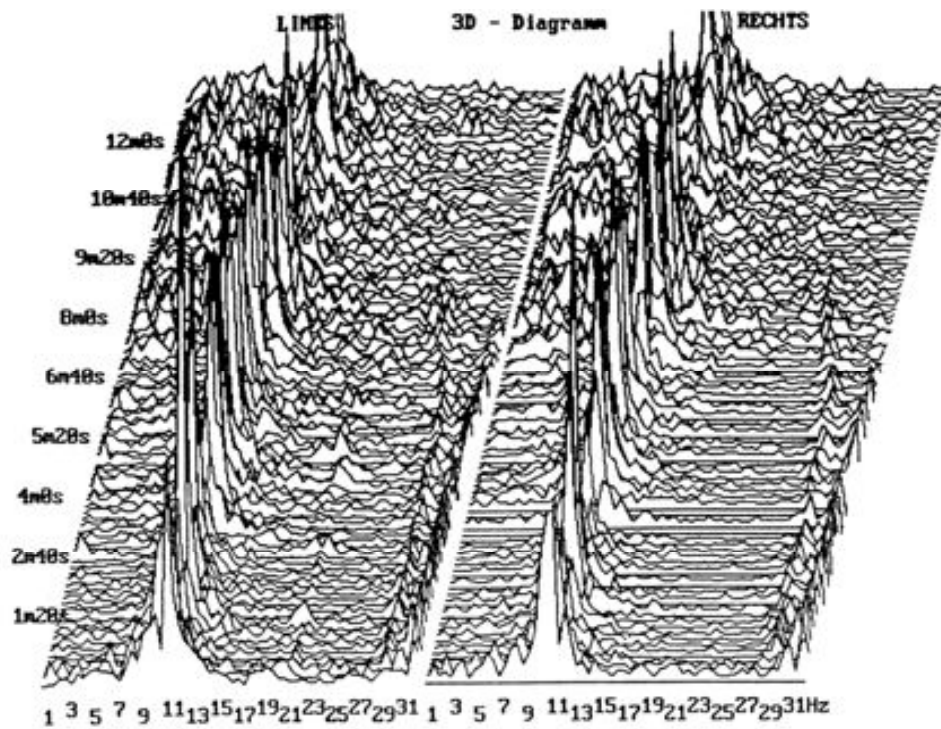


Fig. 3: Chronospectrogram showing disturbances by alternating current

Figure 3: This graph shows a heavy occurrence of alternating current in the right hemisphere due to a standard lamp with a dimmer at the student's working place. Thus, a laterality problem appeared, the cause of which the student was not aware of. Because of this blockage, the student faced a desperate situation which almost made her break off her studies.

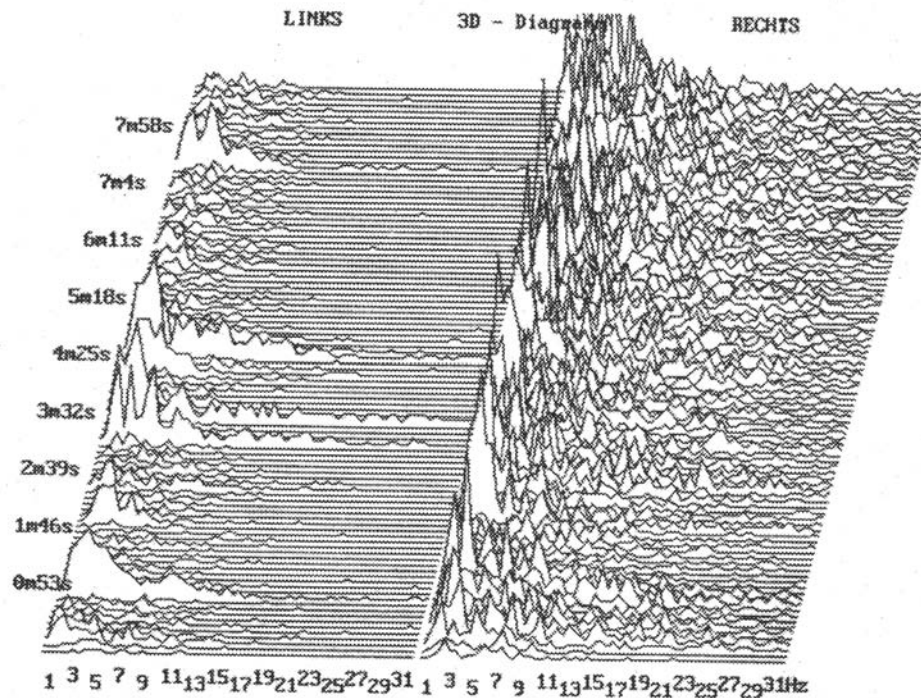


Fig. 4: Chronospectrogram showing laterality problems

Figure 4: This boy came to the Institute with the diagnosis ADHS (attentiveness disability with hyperactivity). His graph showed a disturbance in the networking of the hemispheres. His continuous urge to move had been a necessary strategy to convey the learned knowledge stored in his unconscious right hemisphere to the conscious left hemisphere, and therewith to the verbal process. Whenever he moved he could at least fragmentarily, and in a reduced way, transport the content to the left hemisphere. At the moment he remembered his intention to sit quietly, the amplitudes of the left hemisphere were instantly reduced. Thus, his inner affliction increased again because he could not solve the exercise. When he gave up the control of his movements, he could tackle the task. The moments when he moved and when he tried to be quiet can clearly be seen in the left hemisphere. His tendency to compensate the reduced networking of the right and the left hemispheres by movements is a behavior that puts a strain on the people around him and predetermines the diagnosis of ADHS.

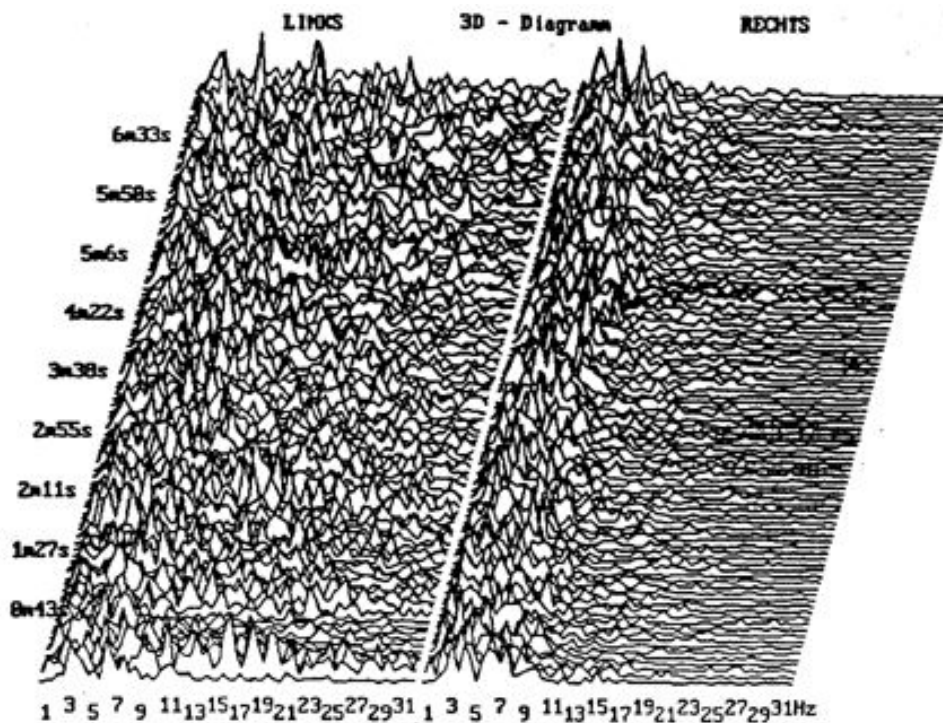


Fig. 5: Chronospectrogram showing dominance of the left hemisphere

Figure 5: This graph shows an obvious dominance of the left hemisphere, because in contrast to the right hemisphere that processes the contents in a structured way, the left hemisphere shows very chaotic patterns. This young man had suffered a car accident. After being in a persistent vegetative state he returned back to life, and could not yet control and deliberately coordinate his actions.

These graphs clearly show problems in communication between the right and left hemispheres. The coordinated work of both hemispheres is a precondition for conscious processing and the use of unconsciously perceived information.

When measuring in the region of the limbic system, balanced patterns in both hemispheres are the condition necessary for good communication between the two hemispheres. Insufficient network structures lead to laterality problems which hinder children in their learning process. Often, they compensate for this problem by getting stimuli through permanent movement in order to be able to meet the demands of their school. As a result of this, they are diagnosed as having ADS (attentiveness disability), and thus only the label has changed—from “learning problems” to “hyperactive child.”

Laterality problems are only one possible cause for learning disorders. There are other typical and frequently occurring basic patterns as causes for learning disorders, which scarcely appear in isolation. It does not play a role whether the name of the investigated problem is ADS (attentiveness

disability), Dyskalkulie (calculating disability) or LRS (dyslexia, a reading and writing disability). In our graphs the problems of the children are shown in the form of lacking or blocked frequencies, phase shifts or disharmonies. We do not see learning disorders as a description of a symptom with a collective name, such as LRS, ADS, Dyskalkulie, etc. Each person must be regarded individually, and each problem with its processing patterns has to be understood as a system.

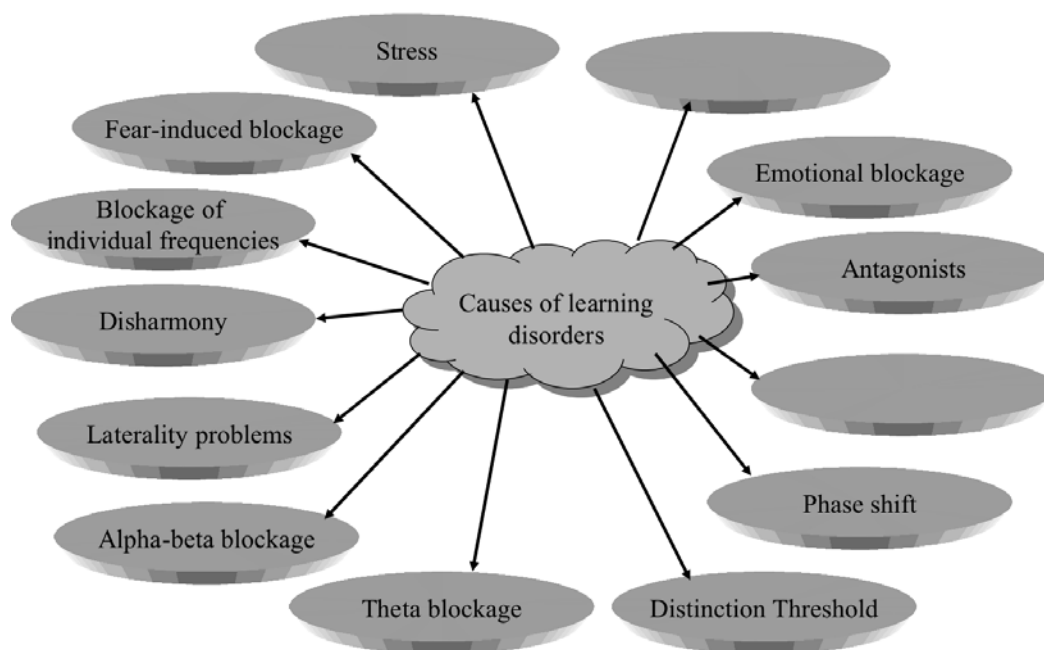


Fig. 6: Possible causes of learning disorders

Knowing these possible causes of learning disorders, which are intensively investigated at the Institute, is of importance for teaching and for schools. These research results make it possible to structure the repertoire of teaching methods for professional and purposeful use. Thus, the formation of many problems in learning and performance can be forestalled.

The brain will not see the necessity of reorganizing or using its plasticity if there is no emergency or an intervention coming from outside. It has developed strategies for compensating for its own problems. These strategies of defense—of being unenthusiastic and unmotivated, of resignation and other attitudes of avoidance towards school learning—are declared by the surrounding people as symptoms of puberty, or simply ascribed to the character of the child. As the brain has already made a lot of experiences with its concepts for resolving problems, these patterns are fixed and have become patterns for acting and reacting. Specific intervention is necessary to initiate and facilitate processes of change.

The Neuroactive Music

For our method of working and our philosophy, it would not have been sufficient to only record the problems through measuring techniques for a diagnosis without providing solutions to overcome these problems and without providing systems to support an autonomous purpose-oriented development for the individual. The discovery that the way the brain works is in accordance with laws in music led us to a new research field: the effect that music can have on the brain. Thus, a neuroactive music has been developed which sets the brain in a state of willingness to learn, and which opens learning windows even out of the sensitive phases and initiates the ability of the brain to become plastic and to reorganize.

This plasticity of the brain enables us for our whole life to build new neuronal networks and new neuronal paths and to transform existing patterns into more complex structures. These processes are intensified if the brain is set in an animated state for learning and when it receives appropriate stimuli in those frequency ranges which are not developed enough for an optimal functioning, or which are disturbed.

The interventions are made as prompters for the brain based on classical music. The production of certain neurotransmitters is stimulated and the brain's willingness to learn is increased by purposeful changes in intonation and tuning of the instruments, by the tempi chosen, and the assembly of the pieces of music. This basic music is arranged according to the EEG spectral analysis measurement in order to stimulate and support the brain in its individual optimization of its processing patterns and to accelerate the learning process.

Listening to this music at home must be accompanied by specific activities in those areas in which an improvement or a change is desired. This neuroactive music can be applied, e.g., for optimization of performance (top sports, management, studies), for promotion of learning (homework, learning of a foreign language, preparation for exams), for overcoming learning disorders (ADHS, LRS, Dyskalkulie), for healing cerebral damage (movement disorders, failures or restrictions, for example, after a stroke, head injury, or for prevention or retarding of failures due to aging or illness such as Alzheimer's disease, Parkinson's disease, multiple sclerosis).

The music can be created only on the basis of an individual measurement. It then will be an individualized support for intensifying, accelerating, or enabling learning processes. Parallel supportive measures through adequate learning programs, therapeutic exercises, voice training, etc., through therapists, teachers and parents is absolutely necessary. Children with school problems listen to their neuroactive music doing their homework and when making movement exercises or sports. The effect of the neuroactive music can be investigated and made apparent by EEG spectral analysis.

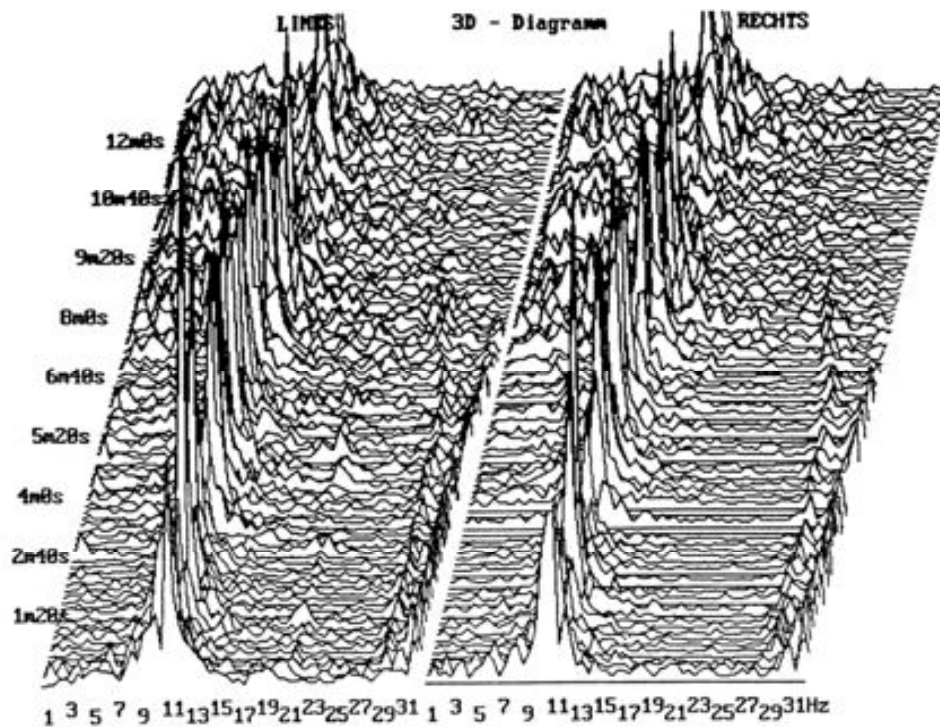


Fig. 7: Chronospectrogram showing stress reduction.
The easing begins after about 7 minutes (see time axis at the left).

The beginning of work with the neuroactive music is similar to a learning process. These new patterns have to be learned. Therefore, it is necessary to listen to this music as regularly as possible and over a longer period. Later, the brain will have these new patterns at its disposal, even without listening to the music.

Case Example

The effect of this special music therapy can be seen in the development steps of children. In a project with a remedial class of a primary school with 7- to 8-year-old children who had delayed speech development, the children had been asked to paint a picture of themselves each day while listening to the music. In this way, the leader of the project tried to obtain information on the state of development of the children. A verbal communication with the children was hardly possible. Because of trauma, some of them had never spoken, or were on the level of a two-and-a-half-year-old child.

The following pictures drawn by a girl who participated in the project speak for themselves.

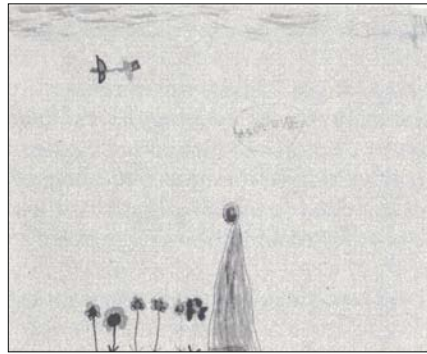


Fig. 8: First day of listening to the neuroactive music

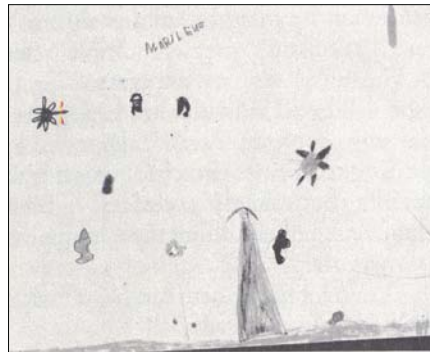


Fig. 9: Third day of listening to the neuroactive music

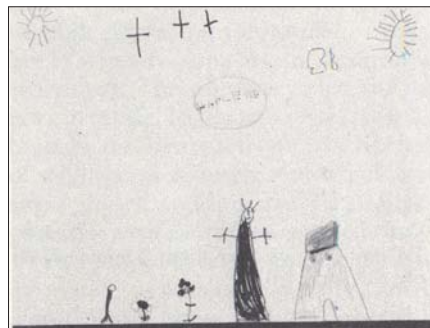


Fig. 10: Fifth day of listening



Fig. 11: Seventh day of listening



Fig. 12: Ninth day of listening

At the beginning of the project, Marlene was at the development level of a two-and-a-half-year-old girl. She hardly spoke, and a test showed her as needing a special school for mentally handicapped children. After the EEG spectral analysis measurements were made, the project passed through two phases. In the first phase, a specific music was applied to make the trauma disappear. Each day the children painted pictures, so that we could see if there were changes in the development of those children with speaking blocks. During this first phase of listening to the music, the children were very clingy and looking for loving care. In part, it seemed as if by their behavior they would retrogress and then build a new self. This could also be seen in the pictures of Marlene, who painted every day a picture of herself. Her drawings became more and more differentiated. The figure she painted at the beginning transformed within two weeks into a laughing girl. In the first phase of retrogression she made one drawing of herself being in a hole, like a uterus. She was able to write her name and wrote her name on all pictures, except this one. In the second phase of the project, a new kind of music was applied to support learning and speaking. One year later, Marlene started school in a normal primary school and still is there today.

Günter Haffelder has surveyed several thousand school children, several hundred healers and countless people with exceptional intellectual abilities at the Institute for Communications and Brain Research where he is the director. He has studied physics, done brain research, and after several successful years as an entrepreneur, including patent psychology, he worked several years in research, as a freelance management trainer, and had a teaching position at a college. In recent years the Institute has become well known both nationally and internationally. It works with an independent staff drawn from the fields of psychology, education, biology, medicine, physics, and computer science. His work is unique and continues to attract the attention of more and more prestigious institutions, schools, and clinics. Research projects in Austria, Switzerland and Poland are currently in progress.

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THE ADVANTAGE AND DISADVANTAGE OF BRAIN RESEARCH FOR PEDAGOGY

by
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translated by
Peggy Elliott

1. Brain Research and Pedagogy

Researching the brain has brought some useful insights into a deeper understanding of teaching and education. Some research results, however, only confirm what is already known or believed to be known in pedagogy; yet they are important as far as they provide a necessary background for educational policy and because they deepen one's own knowledge. Other research opens new and sometimes surprising insights into the organic basis of human development.

One of the most important insights is the discovery of the *environmental setting dependent plasticity of the human brain*. This means that the brain structure may change continuously, particularly during childhood, but also in adults, dependent on experience and spiritual activity of the individual.¹ To some degree human beings continue to develop new structures of the brain as they stimulate certain areas and neglect others, depending on their activities and interests. This does not relate only to the *renewal of synaptic connections* between the brain cells and those areas, which are particularly stimulated (e.g., through skilled occupation). As new research suggests, certain experiences encourage a *regeneration of cells* at least in some areas of the brain (this is the so-called neurogenesis, for example when olfactory neurons react to a new scent). We thus are lifelong sculptors of our brain and also active co-designers of an important organic condition for more or less complex emotional and spiritual abilities.

This plasticity of the brain advocates a versatile but ordered and not too demanding educational level for the child—a balanced education of head, heart and limbs. Only through such “whole” experiences can human beings be enabled through their organic brain rudiments to react to given

1. Brain research in that respect confirms Rudolf Steiner's findings, which were published as early as 1909 in his essay *The Education of the Child*. See also: Christian Rittelmeyer: *Pädagogische Anthropologie des Leibes. Biologische Voraussetzungen der Erziehung und Bildung*. Weinheim 2002, Kapitel 4.

challenges in a flexible, socially appropriate and creative way.² Ultimately it is physical activity and emotions, which according to brain research are decisive for learning experiences, that allow learning experiences to manifest themselves brain-organically. In this respect research contradicts the intellectual or cognitive interpretation given to it by demands for “brain jogging,” “PISA-Power training” or similarly uninspiring “neurodidactic recommendations.” Instead brain research shows clearly that instructional learning does not lead to “storage” of what has been learned in the long run. Often sensual experience, happiness and disappointment, wonder and discomfort are *constituent* elements of learning and brain development.³ It is the ordered multiplicity of experience, the association richness of artistic and other creative activities of the experienced environment, which also produce an association-rich brain structure, that in itself seems to be an *organic* condition for creative thinking and complex emotional cultures. An educational and socio-economic condition that favors channeled experiences also leads to an impoverishment of the “brain paths” of the neurological landscape.

Insight into the brain’s plasticity has led to an abundance of pedagogically important research. For example, media psychology and brain research have enabled interesting insights into a culture dominated by *screen media in the lives of adolescents*. It is very likely that the dominance of visual media leads to a culturally determined “alteration” of young brain structures, particularly if at the same time an impoverishment of literary competences occurs: Areas of the brain that are important for language and literary abilities are depleted while certain motor and visual areas are developed more extensively. A much quoted example of such effects is the discovery of the enlarged thumb representation in the brain of adolescents who send multiple SMS messages. The consequences of such structural change to the brain, for example for the language competence of young people referred to in the PISA-Studies or for the development of imaginative forces, is obvious.⁴ Especially language with its implicit hierarchies and syntactic figures, but also mime, gesture, movement and social interaction, practical experiences in school and the emotional exchange with other people are examples of important building stones for a competence-enhancing brain development according to brain researcher Wolf Singer. The dominance of screen media in the life of many children and the accompanying social isolation is therefore—as psychological research shows—organically anti-educational because they limit the chances of development in adolescence.

2. See also G. Hüther: Die Strukturierung des Gehirns durch Erziehung und Sozialisation. In A. Neider (Hrsg.): *Wer strukturiert das menschliche Gehirn? Fragen der Hirnforschung an das Selbstverständnis des Menschen*. Stuttgart 2006, pp. 11–26.

3. See e.g. G. Hüther: *Bedienungsanleitung für ein menschliches Gehirn*. Göttingen 2001; C. Nitsch/G. Hüther: *Kinder gezielt fördern*. München 2004; M. Spitzer: *Lernen. Gehirnforschung und die Schule des Lebens*. Darmstadt 2002.

4. I have described the problem of video games and too much television in my book *Kindheit in Bedrängnis. Zwischen Kulturindustrie und technokratischer Bildungsreform*. Stuttgart 2007. See also M. Spitzer: *Vorsicht Bildschirm*. Stuttgart 2005.

From a pedagogical point of view, an insight into the individual brain structure of each child is also important—even with identical twins. The reason behind this is the experience dependency of the individual human brain formation. No brain completely resembles another because there is no absolute identical level of experience for human beings.⁵ Different levels of development in different children of a certain age can be explained with these effects on different brain structures as a consequence of specific experiences—and asks for a marked alertness of the educator at these stages of development in the individual child and argues against rushing to a conclusion of what a child should be able to do at a certain age.

This forms an important argument against any blanket generalized statements about the learning process—for example, that for this reason pupils should not be measured with the same stick and subjected to any standard program without individual contact and encouragement. In Germany this conclusion also relates to the current increase in early enrollment of children into schools. This undimmed euphoria for an alleged early advancement is noticeably accompanied by research that shows that a significant number of children enrolled later (at the age of about 6 years) show better school results as those enrolled earlier (at the age of about 5 years) or, at the least, do not display any general advantage of early enrollment.⁶ An international survey by the *British Association for Early Childhood Education* concludes that enrollment prior to the age of 6 years has no advantage for language and mathematical skills of the children.⁷

Recent brain physiological studies by Philip Shaw and his colleagues show that children with a relative slower development speed during their preschool and primary school years later often achieved a thicker layer of the brain neocortex and better intellectual benefits than children whose increased development was subjected to a relatively intensive “early promotion.”⁸ A depletion of this region of the brain, according to researchers, does not only have consequences for the three areas of the “three main competencies” (reading, writing, arithmetic), but also for the capacity to digest and integrate sense impressions. Thus David Shore and his co-workers’ research result becomes clear—children can adequately learn integration of different complex sense impressions up to the age of 10 years only if they are allowed sufficient time and space for development.⁹ Summing up their empirical

5. The “experience environment” of course has to be seen in connection with the individual from whose perspective it gains its specific outline.

6. See Christian Rittelmeyer: *Kindheit in Bedrängnis*. Stuttgart 2007, Vorwort.

7. House of Commons: Education Select Committee Report: *First Report: Early Years*. London 2000.

8. I would like to thank Maximilian Moser for this information. See P. Shaw a. o.: Intellectual ability and cortical development in children and adolescents. In: *Nature* 440 (2006), S. 676-679; also the commentary by G. Miller: The Thick and Thin of Brainpower: Developmental Timing Linked to IQ. In: *Science* 311 (2006), S. 1851; R. Passingham: Brain development and IQ. In: *Nature* 440 (2006), p. 619.

9. See D. I. Shore a. o.: The development of change detection. In: *Developmental Science* 9 (2006), pp. 490–497.

results of the development of perception, the authors say that children have to be able to adopt a “pace” for learning that relates to their individual ability to learn and that is not subject to curriculum guidelines.

Many research results are of high pedagogical relevance although they tend to portray early indications as sound conclusions. Into this category belongs, for example, the discovery that an essential part of long-term effective learning takes place during sleep—providing there is a good sleep structure—which was researched, among others, by Maximilian Moser from a chrono-biological perspective.¹⁰ During deep sleep the experiences of the day, which are “deposited” in the short term memory, are communicated from the hippocampus to the neo-cortex—a kind of communication takes place between the two brain organs—so that what has been absorbed during the day is incorporated into what has hitherto been experienced and thus builds a structure (although it is still unknown “who” causes this communication).¹¹ The calamity of the above-mentioned brain physiological discoveries becomes evident in connection with media-psychological research, which states that in TV-addicts (more than 3 hours per day), the sleep structure becomes dysfunctional and there is an increase in the attention deficit and hyperactivity disorder (ADHD) syndrome.¹² Then, to combat this attention disorder partially caused by increased viewing hours and other stress factors, astonishingly, medications are prescribed such as Ritalin, which, according to the latest research again, have long-term negative effects on the young brain.¹³ This example shows that brain research in connection with further research results can highlight the dangers to which children are subjected by modern cultural industry.

However helpful the indications are that pedagogues can take from brain research, a critical view of the dangers for pedagogy has to be adopted with

10. M. Moser/D. von Bonin/M. Frühwirth/J. Herfert/H. Lackner/F. Muhry and Christian Puelacher: Luftkunst. Von der Fähigkeit, mit dem Atem das Herz und den Körper zum Klingen zu bringen. In: *Luft. Elemente des Naturhaushalts IV*. Schriftenreihe Forum Band 12. Kunst- und Ausstellungshalle der Bundesrepublik Deutschland (Hrsg.), Köln 2003, pp. 270–283. Ferner M. Moser u. a.: Endbericht schul.support. Johanneum Research/ Institut für nichtinvasive Diagnostik. Weiz (Österreich).

11. See in more detail M. Spitzer: *Lernen. Gehirnforschung und die Schule des Lebens*. Darmstadt 2002, p. 121ff. and Christian Rittelmeyer: *Kindheit in Bedrängnis. Zwischen Kulturindustrie und technokratischer Bildungsreform*. Stuttgart 2007, Chapter 1.

12. Chr. Rittelmeyer: *Kindheit in Bedrängnis. Zwischen Kulturindustrie und technokratischer Bildungsreform*. Stuttgart 2007, p. 49ff., D. A. Christakis/ F. J. Zimmermann/D. L. DiGuseppe/C. A. McCarthy: Early television exposure and subsequent attentional problems in children. In: *Pediatrics 113* (2004), pp. 708–713.

13. L. Diller: The Rise of Ritalin. Triumph and Tragedy of the Medical Model in Children’s Mental Health. In: S. Olfman (editor): *No Child Left Different*. Westport 2006, pp. 143–162; R. De Grandpre: *Ritalin nation: Rapid-fire Culture and the Transformation of Human Consciousness*. New York 1999. Deutsch: *Die Ritalin-Gesellschaft. ADS: Eine Generation wird krankgeschrieben*. Weinheim 2005; J. D. Gray u. a.: Methylphenidate Administration to Juvenile Rats Alters Brain Areas Involved in Cognition, Motivated Behaviors, Appetite, and Stress. In: *Journal of Neuroscience 27* (4. July) 2007, pp. 7196–7207.

this research. It is characterized by three problems: the lack of historical reflection by its protagonists and supporters, the methodological and philosophical problems of numerous experiments and the picture of man based on it, and finally its neurocentrically-constricted viewpoint in which the head and, in particular, the brain within it reside like a kind of Ludwig XIV above the rest of the body, the rank and file, in this anthropological panoptic. The following points might demonstrate the problems.

2. Basic Problems of Brain Research

a) Lack of historical reassurance

If one is concerned with the history of science one will discover that the formulation of questions and the central concepts of certain disciplines often consist of mirrored thought and interpretation patterns which are characteristic, beyond science, of the culture they constitute. It could be termed a “historical syntax,” which leads humanity’s thinking and feeling without it being conscious of it.¹⁴ This asks for critical verification of the historical choices for certain disciplines, insights and perceptions if one wishes to understand its underlying social trends. Here is not the place to look into this in more detail. However, I would like to mention one theory because it concerns a problem of brain research that carries consequences for pedagogy.

If one looks more closely at the concepts favored by [German language] magazines and journals which are meant to exemplify a “brain-appropriate education,” one clearly notices an analogy between man and machine. They speak of “computer” (instead of brain) and the “wiring of nerve cells in early childhood through early intellectual development” of “brain modules,” of the “interconnection of brain cells in babies,” of a “neurological layout” of the brain, of “updates for learning,” of “neuro hardware” and of the “software of learning.” They speak of the “child’s RAM,” of the “hard disc of the brain” and equally of the “neuron data motorway” or of the “cabling of brain modules.” In an increasing number of pedagogical theories and reports, allusions to aesthetics, creativity, unexpected learning results, moral abilities and open learning processes are replaced by a metaphoric that equates children and machines: The “information-processing approach of education” prevails.¹⁵ According to these technocratic apologists we carry a “learning machine” in our heads. They report that conditioned by visual media the “the head’s neurological cables are being relocated in the PC-Generation,” and so on.

14. See in detail: Chr. Rittelmeyer/H. Klünker: Lesen in der Bilderschrift der Empfindungen. Erziehung und Bildung in der klassischen griechischen Antike. Stuttgart 2005, p. 301ff.

15. S. Olfman (Editor): *All Work and No Play... How Educational Reforms Are Harming Our Preschoolers*. Westport/London 2003, Einleitung. Ausführlich dazu Chr. Rittelmeyer: *Kindheit in Bedrängnis. Zwischen Kulturindustrie und technokratischer Bildungsreform*. Stuttgart 2007, p. 97ff.

This is not simple “press German.” A considerable number of brain researchers have initiated this technical vocabulary. Completely blind to what manifests within the brain as a phenomena, they have brought the terms “wiring” and “circuitry” of nerve cells into the discussions—“mechanical clumsiness” as Friedrich Nietzsche called this thought and speech format. Toddlers with speech defects are diagnosed with “micro-circuit-dysfunction” and we see “babies as control groups.” The “neurons fire synonymously” instead of exchanging signals and impulses in a mutual rhythm; the “synaptic circuitry” takes the place of connections between nerve cells and “modules” or “cluster” instead of organic units.

This mechanization of the world-view is not only typical for many brain researchers—it is today a general cultural habit. Susanne Wickum-Glinski was, for example, able to show through the body symbolism of contemporary children and teenage literature, that the “machine metaphor” found its entry into this genre in the 1980s (in particular in non-fiction).¹⁶ Nerves are called “news nets” or “telephone cables,” the eye is the “camera” or a “living camera,” the sense of touch goes as feeling “apparatus,” the kidney as “filter” or “purification plant,” the spleen is a “trash can,” the spinal disc a “bumper,” the joints are “joysticks,” the heart is a high performance “pump” or “engine,” the liver the central “laboratory,” and so on.

A similar trend of mechanization of man is found in movies (like *Batman* or *Star Wars*), in toys and comics. Thus the series *X-Men* shows a strange mix of man and machine; the toy industry offers a rich assortment of mechanical human forms or “human machines” and, least but not last, videos and cyber-space action games often make use of these militarized figures. At the same time, I believe, there is a rapid destruction of the human picture of mankind through a high number of evening TV programs in which sexual relationships are reduced to mutual “benefit-unions.”¹⁷ The post-modern proclamation of the “dying subject” and the questioning of the human individuality, in short, the constructivist interpretation of the world, all belong in this context.¹⁸ The neuron-theoretical debate about free will (see the following chapter) and the mechanical metaphors of brain research appear, in this context, to be symptoms of a much deeper underlying cultural trend, which numerous

16. S. Wickum-Glinski: *Die Darstellung des menschlichen Körpers im Kinder- und Jugendbuch von der Aufklärung bis zur Gegenwart*. Diss. RWTH Aachen, Herzogenrath 1998, p. 209ff.

17. Diane Levin describes this trend in more detail in: So sexy, so soon: The Sexualization of childhood. In: S. Olfman (editor): *Childhood Lost*. Westport/London 2005, pp. 137–154. Also of interest is the new study by the Kaiser-Foundation, USA, according to which sexually implicit TV-programs before 10.00PM have doubled since 1998. See: The Henry J. Kaiser Family Foundation: Sex on TV 4. Executive Summary 2005. Internet edition 2005. For results of this sexualization see the latest report by the American Psychological Association: Report of the APA Task Force on the Sexualization of Girls, 2007 (on the internet).

18. Christian Rittelmeyer (ed.): Individualität und Autonomie. Zur Geschichte des. Themenheft der Zeitschrift *Bildung und Erziehung* 46 (1993).

brain researchers and their pedagogical servants loyally applaud—instead of uncovering and developing other paradigms of brain research.

b) The methodical and philosophical problems of neurological research and the picture of humanity based on it

Provocative and therefore enticing discussions have been caused in particular by the claim of some brain researchers (such as Wolf Singer and Gerhard Roth) that man has no free will. If one gives a test person a decision task and observes his/her brain activity prior to and during the experiment, the results show that often, shortly before the (assumed) actual conscious decision, decision-activating impulses arise from deeper lying levels of the brain. That, allegedly, speaks for a non-conscious “pre-decision” of the brain. This shows, albeit rather simply expressed, the type of argumentation for the above-mentioned claim.¹⁹

From the perspective of research methods this “insight” already illustrates, however, arises a series of problems. As the test person was observed in an operative environment like the magnet-resonance-tomography or under the restrictions of an ECG-cap, the question remains whether a “free” decision is at all possible under such conditions—or whether the results produced methodical artifacts. If one goes on to test what critics of the idea of human freedom understand by “will,” one usually encounters an astonishing naïveté in the definition of this term, which to this day has not been clarified within the discipline of psychology (for example in the simple equation between “will” and “conscious decision” or in the opinion that free deeds of will can be localized in the neocortex). Some researchers whose results are interpreted in this naive fashion have in the meantime warned of hasty conclusions.²⁰

Far more comprehensive has been the philosophical critique on the hypothesis of the non-existence of freedom of will.²¹ This is because concepts like responsibility or guilt would lose their meaning if decision making processes were only instigated by unconscious or pre-conscious activity of the brain and not at least partially and temporarily by a free

19. W. Singer: *Der Beobachter im Gehirn*. Frankfurt/M. 2002; ders.: *Vom Gehirn zum Bewusstsein*. Frankfurt/M. 2006; ders.: *Neurobiologische Anmerkungen zum Freiheitsdiskurs*. In: *Berlin-Brandenburgische Akademie der Wissenschaften* (Hrsg.): *Zur Freiheit des Willens 2*. Berlin. Berlin-Brandenburgische Akademie der Wissenschaften 2006, pp. 17–26. G. Roth: *Fühlen, Denken, Handeln. Wie das Gehirn unser Verhalten steuert*. Frankfurt/M. 2005; ders.: *Das Gehirn und seine Wirklichkeit*. Frankfurt/M. 1997.

20. Benjamin Libet in his book *Mind Time – Wie das Gehirn Bewusstsein produziert*. Frankfurt/M. 2005. For more relating to the problems of the neuro-biologic concept of will see P. Gehring: *Es blinkt, es denkt. Die bildgebenden und weltbildgebenden Verfahren der Neurowissenschaft*. In: *Philosophische Rundschau* (51) 2004, pp. 273–293.

21. As an example please refer to the debate between Wolf Singer, Jürgen Habermas and others in: *Deutsche Zeitschrift für Philosophie* Nr. 52 (2004), vgl. den Schwerpunkt “Hirn als Subjekt?”; also J. Habermas: *Zwischen Naturalismus und Religion*. Frankfurt/M. 2005; Christian Geyer (ed.): *Hirnforschung und Willensfreiheit*. Frankfurt/M. 2004; M. Pauen: *Illusion Freiheit? Mögliche und unmögliche Konsequenzen der Hirnforschung*. Frankfurt/M. 2004.

deciding individual and would have considerable consequences for institutions such as our legal system, for philosophy or pedagogy. For example, the leading thought of modern pedagogy, where children are to develop into decision-making, autonomous and responsibly acting human beings, would be exposed as an illusion. Indeed, for some pedagogues a “brain-correct” education already takes precedence over a “child-correct pedagogy”—the brain becomes the beneficiary of educational endeavors.²²

Besides allegations that such deterministic hypotheses by some brain researchers express a tendency for naturalization, which is observable as a zeitgeist-phenomena far beyond brain research (see the above mentioned deliberations), this point of view also receives a fair amount of criticism for its lack of reflection. For example, the philosopher Peter Bieri remarks as follows on the described deterministic interpretations of neurological findings: “What appears like a sound empirical refutation of the free will is a bizarre piece of metaphysics.”²³ However, I don’t believe that at present discussions develop along the lines of these sharp-coined confrontations but rather try to find a middle way. According to this more moderate view, free will or autonomous individuals have long been accepted by philosophy and therefore brain researchers would only preach to the already converted.²⁴ Other critiques of the deterministic hypothesis maintain different “language games” (which basically were previously formulated by Immanuel Kant in relation to the problem of freedom). For the natural sciences, causal and deterministic sample statements are necessary (except in certain areas like quantum physics), which, however, cannot be simply transferred to spiritual scientific questions about human freedom without committing a categories error.²⁵ As already mentioned, the methodical shortcomings of many studies, however, do not allow for a focus on the subject of free will—which is reflected within the framework of the “historical syntax” as just a certain view of the world, which is not even generated here and only replicated. The

22. See J. Giesinger: *Erziehung der Gehirne? Willensfreiheit, Hirnforschung und Pädagogik*. In: *Zeitschrift für Erziehungswissenschaft* 9 (2006), pp. 97–109. Zum “gehirngerechten Lernen” auch U. Herrmann (ed.): *Neurodidaktik*. Weinheim 2006.

23. P. Bieri: *Unser Wille ist frei*. In: *Der Spiegel* 2/2005, pp. 124–125. Ders.: *Das Handwerk der Freiheit. Über die Entdeckung des eigenen Willens*. Darmstadt 2001. Siehe ferner zur begrifflichen Differenzierung auch M. Frank: *Selbstgefühl. Eine historisch-theoretische Erkundung*. Frankfurt/M. 2003.

24. This debate was actively ongoing in the 1980s in philosophy (and other disciplines like pedagogy), see K. Meyer-Drawe: *Illusionen von Autonomie. Diesseits von Ohnmacht und Allmacht des Ich*. München 1990; M. Frank: *Die Unhintergebarkeit von Individualität. Reflexionen über Subjekt, Person und Individuum aus Anlass ihrer “postmodernen” Toterklärung*. Frankfurt/M. 1986; H.-G. Brose/B. Hildebrand (Hrsg.): *Vom Ende des Individuums zur Individualität ohne Ende. Opladen* 1988; E. Tugendhat: *Selbstbewusstsein und Selbstbestimmung*. Frankfurt/M. 1979.

25. E.g., B. W. Carl: *Bewusstsein und Neurowissenschaften*. In: *Georgia Augusta. Wissenschaftsmagazin der Georg-August-Universität Göttingen: Gehirn und Verstehen*. Ausgabe 2/2003, pp. 16–21; U. Kasper: *Kann die Quantentheorie den Hirnforschern helfen, Probleme zu verstehen?* In: *Deutsche Zeitschrift für Philosophie* 52 (2004), pp. 921–927.

philosopher Petra Gehring pointed to this situation by referring to the colorful pictures of the brain metabolism in the title of a critical essay as: “It blinks, it thinks. The pictures and world views of neuroscience procedures.”²⁶

Such an observation certainly does not conclude the debate. Undoubtedly, however, it has produced a different level of research and argumentation than that favored so far by some brain researchers. Even more urgent than an analysis of this discussion, I think, is the debate of a different problem, especially in view of the pedagogical importance of brain research. The alleged observation of brain activity, which in reality is only a process of metabolism and/or blood-circulation, reveals the curious fact that it completely overlooks the body below the head.²⁷ But does our thinking activity really only take place in the head? Many brain researchers obviously make this assumption. In a book by Manfred Spitzer it says succinctly: “Learning takes place in the head.”²⁸ In a lecture at the University of Göttingen in 2006, Wolf Singer emphasized: “All knowledge resides within the functional structure of the brain.” On the other hand, the psychologist Erwin Straus entitled one of the chapters in the second edition of his study “From the Sense of Senses” (1956): “Man thinks, not the brain.” Who is on the right track?

c) Who thinks and judges—the whole man or the brain? The danger of a neuro-centralistic short sightedness

In order to answer this question, I would like to present some findings which were the result of a substantial research project on the effect of school architecture on adolescents.²⁹ How does the perception, for example, of a school’s frontage or a certain color come about and—particularly important for our subject—how does it lead to certain judgments about what is perceived? Is it a process that takes place only in the brain? As our studies show, this is not the case.

Every perception of constructed and decorated rooms incorporates different sense activities, i.e. the collaboration between, for example, the senses of hearing, seeing and balance. Perception simultaneously connects via the so-called outer senses (e.g., seeing and hearing) with the own body via so-called inner senses (e.g., sense of movement and temperature). The cognition of architecture is therefore subject to the involvement of the whole human body and demands a more detailed analysis of the collaboration of different sense qualities (so-called synthesis) through which we access (mainly consciously) architectural structures. The activated sense field

26. In: *Philosophische Rundschau* (51) 2004, pp. 273–293.

27. M. I. Posner/M. E. Raichle: *Bilder des Geistes. Hirnforscher auf den Spuren des Denkens*. Heidelberg 1996.

28. M. Spitzer: *Lernen. Gehirnforschung und die Schule des Lebens*. Darmstadt 2002, p. XIII.

29. See in more detail: Chr. Rittelmeyer: *Pädagogische Anthropologie des Leibes*. Biologische Voraussetzungen der Erziehung und Bildung. Weinheim 2002, Kapitel 2.

defines the impression a building makes on us. We were, for example, able to determine in our structural-psychological studies that some students reacted with a slightly increased skin temperature in the chest region to an environment with “warm” colors (like yellow) and with a slightly lower temperature with cooler colors (like a whitish blue). These warmer or cooler properties correspond to the moods that are for example provoked by different coolers and room temperatures. It appears that the registration of color in the brain leads to an impulse within the periphery of the chest where it stimulates the blood flow by either increasing or decreasing it. The temperature differences, which then occur, are re-transmitted via thermoreceptors to the brain and there connect to the actual sense impression of the object. “Outer (visual) and “inner” (thermo) impression are joined to form the synaesthetic impression of quality of the building. Only this interaction between inner and outer senses leads to a positive or negative categorization of the perceived architecture (“It leaves me cold”—“It gives a warm feeling”—“It depresses me,” etc.).

As in this example the senses of temperature and sight collude in judgment with the senses of sight, movement and balance, working together every time a building is perceived, sometimes due to a particular movement of the observer’s eye induced by the form of the frontage itself during its beholding. We actually unconsciously take visual hold of objects with jerking eye movements (so-called rapid eye movement). These eye movements aroused by specific building forms can be demonstrated visually with the aid of instruments. The sensors of our own sense of movement in muscles and tendons “notify” the brain of the specific movement shape, and the unconscious experience of the movement within the body then connects with this visual impression of the building. Thus within the whole body of the observer, the impression is created of, for example, a “living” or “boring” structure. Buildings with contours, slopes and so forth often appear enlivening because the eye movement follows these different forms and thus traverses different directions. Buildings shaped like a box, for example, tend to appear boring, rigid or lifeless, because horizontal and vertical eye movements dominate.³⁰

Judgments like “this building appears dismal” or “this room leaves me cold” are not produced solely within the brain but are based on processes within the whole body.³¹ How important processes within the body’s periphery are for forming an opinion within the “center” has been shown in numerous new studies including those using imaginative activities. The Italian researcher Vezio Ruggieri was able to show that even imaginations of distant or near objects are connected to light eye movements as are those with actual perception of such objects (“close up and distance adjustment”).³²

30. In more detail in Chr. Rittelmeyer: *Schulbauten positiv gestalten. Wie Schüler Farben und Formen erleben*. Wiesbaden 1994.

31. Also Chr. Rittelmeyer: *Wie wirken Schulbauten auf Kinder und Jugendliche?* In: *Erziehungskunst* (60) 1996, pp. 739–753.

32. See in more detail Chr. Rittelmeyer: *Pädagogische Anthropologie des Leibes*,

Ruggieri, as well as Swedish psychologists, were able to prove that while subjects were looking at grimaces or jolly or sad faces subtle, outwardly not visible activity takes place in just those face muscles of the observer, which are necessary to bring about just this type of grimace.³³ Similar imitation and response phenomena have also been found by other researchers and have been ascribed partly to the activity of so-called mirror neurons.³⁴ We react physiognomically while observing comic expressions in others, although unconsciously. Research of this type shows that perception and opinion processes are always accompanied by physiological processes within the whole body, which are mirrored via the “inner” sense system into the brain and there connect with the visual or acoustic outer sense to form the experienced phenomena of the perception. This whole body activity makes up the complete perception and shows that it cannot be purely brain process.

What is the anthropological significance of this “body response”? In a lecture in the *Study of Man* cycle (August 1919), Rudolf Steiner pointed out how deductive perception arises out of the activity of different sense organs: “If a man perceives a colored circle he simply says: I see the color, I see also the curve of the circle, the form of the circle. But there we have two completely different things looked upon as one. What you perceive immediately through the real activity of the eye apart from the other senses is only the color. You see the form of the circle by making use of the sense of movement in your subconsciousness, and you make the form of the circle unconsciously in your etheric body, in your astral body, and then you raise it into knowledge. It is because the circle which you have taken in by means of your sense of movement comes up into knowledge, that what you have recognized as a circle connects itself with the color which you perceive. Thus you call forth the form from your whole body by appealing to the sense of movement, which extends throughout your body.”³⁵

Elsewhere I have already explained this participation of the whole body (i.e. the whole of the sense system) during perception using a response model and the above-mentioned impact of color exemplifies this.³⁶ According to this model, colors (and, in the widest sense, objects of outer perception) are registered in the central nervous system. The sight impression moves via the eye and the optic nerve to the brain. If it were registered only in the central nervous system, one could assume that it would remain an activity

Weinheim: 2002, p. 95ff.

33. V. Ruggieri/M. Fiorenza/N. Sabatini: Visual Decodification through microimitation. In: *Perceptual and Motor Skills* 62 (1986), pp. 475–481; U. Dimberg/M. Thunberg/K. Elmehed: Unconscious facial reactions to emotional facial expression. In: *Psychological Science* 1 (2000), pp. 86–89.

34. J. Bauer: *Warum ich fühle, was du fühlst*. Hamburg 2006; K. Gaschler: Die Entdeckung des Anderen. In: *Gehirn&Geist* 10/2006, pp. 26–33.

35. R. Steiner: *Study of Man*, Lecture 8. See also R. Steiner: *Zur Sinneslehre*, herausgegeben v. Christian Lindenberg, Stuttgart 1981.

36. *Pädagogische Anthropologie des Leibes*. Biologische Voraussetzungen der Erziehung und Bildung. Weinheim 2002, Kapitel 2.

irrespective of the act of sight—a “monotonous look.” According to this model, active perception, evaluation and accentuation (for example in line with the quality of experience of warm or cold colors) come about only when an impulse of the central nervous system reaches the periphery where the blood circulation is stimulated and the temperature is increased. Through the sense of temperature this peripheral process is “mirrored” into the relevant areas of the brain. The body periphery functions as a kind of response body comparable to the sound board of a violin, which turns the string vibrations into sound. Correspondingly perceptions are configured by the synaesthetic activation of the whole sense system into a lively interest in the world, which allows us to discriminate, accentuated, positive or negative, warm or cool assessment of our world.

Therefore a neuro-anatomically manifested, all-round sense development is at the same time a development of our ability to form judgments. With this, the neurocentrically short-sightedness of many brain researchers becomes evident: The “firing” of so-called mirror neurons during observation of a crying human being is possibly less a mirroring of the observed phenomena than the miming and synaesthetic perception of one’s own body. We ourselves copy the physiognomic opposite—even if unconsciously—and only this allows us to form opinions and to look at a face not “monotonously” but participative. These examples might highlight how important it is to always look at a human being as a complete being and not to be short-sighted by considering only the processes of the brain or the cognitive faculties.

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THE SYMPHONY OF LIFE¹

IMPORTANCE, INTERACTION, AND VISUALIZING OF BIOLOGICAL RHYTHMS

by

Maximilian Moser, Matthias Frühwirth, and Thomas Kenner

translated by
Maximilian Moser

Biological rhythms in a wide range of frequencies are present in the whole organism as well as within each living cell. Some of these rhythms reflect adaptations to cosmic cycles and help to anticipate changes in the environment. Others integrate and coordinate body functions. Extensive coordination has been found between different rhythms, indicating a systemic temporal cooperation. Rhythms and their interaction might be more important for human health than has been realized before. Disturbance of the circadian rhythms by night-shift work or jet lag not only disrupts our metabolic balance but also increases the risk of cancer as well as cardiovascular diseases, which together account for 70% of all causes of death in industrialized countries. Rhythms in the organism obviously stabilize the systemic functions. They maintain organismic stability by calibrating the system's characteristics during sleep and rest when rhythms are also most present. Regulation curves in time and space are crucial for controlling physiological long-term stability. To be continuously aware of its properties, an autopoietic system may vary its parameters at different frequencies simultaneously, according to what our body does, e.g., in heart rate variability (HRV). Methods such as autochronic imaging [27], [28] allow the visualization of the body's proprietary rhythms, which are present in long-term heartbeat and brainwave recordings. Similar to spatial x-ray images of the body, they provide a temporal image of our time structure.

Tuning and synchronization of rhythms reduce energy expenditure. Huygens already observed the synchronization between two pendulum clocks mounted on a wall. The synchronization occurred and became stable spontaneously and obviously reduced the drain of energy. It was determined later that synchronization is a frequent phenomenon observed in the human body rhythms and can be found, for example, between heartbeat

1. Printed with permission of Mr. William Hagen, IEEE –*Engineering in Medicine and Biology*, January/February 2008.

and respiration and between blood pressure and blood perfusion rhythms, especially when we relax or sleep. At times when energy consumption is expected to be minimal, our body is working most efficiently. In two recent papers [1], [2], an additional aspect explaining the necessity of oscillations has been introduced. Chemical reactions need a certain environment, for example, for reducing or oxidating. As space is limited in a cell, temporal compartmentalization allows different environments to occur in the same space unit but at different times. No transport is needed and the same space can be used for subsequent chemical processes that would not be possible simultaneously [1] due to differing enzymatic and chemical requirements. A similar concept may also apply to more complex organs and even organismic processes. Systole and diastole, inspiration and expiration, work and relaxation, wakefulness and sleep, and exhaustive and recreative states cannot happen efficiently at the same time. Temporal compartmentalization is probably the most efficient way to mediate between these polarities and provide periods for both poles. The understanding of the cyclic nature of our lives opens a new and very exciting insight into the human body's functioning. Biological time and its oscillations gain more attention and importance as these interrelations are explored or researched and understood.

Cosmic Connections

For eons, organismic life has been exposed to various cosmic cycles, the most evident of which is the rotation of the earth resulting in the geological day, which occurred about a billion (10^{12}) times during the last 3000 million years since life occurred. Although for a long time these external influences were thought to be responsible for the cycling physiological patterns, we know since the work of Aschoff [3] that our bodies' clocks are working independently, but triggered by Zeitgebers cues, which help to establish and stabilize biological rhythms. Temporal adaptations to the external cycles of dark and light or cold and warmth, consequently, have found their ways into the human genome. Regulation centers such as the suprachiasmatic nuclei or the pituitary are involved in the coordination of the internal circadian cycles as well as several genes of the so-called clock, cryptochrome, and period families [4]. The biological significance of an internalized image of external rhythms is obvious as it helps to anticipate changes of the external environment. The ergotropic functions of work (collecting or hunting for food), fight, and flight are needed mainly during the day, the trophotropic analogs of digestion, immune system function, and regeneration are maintained during the rest phase, which in human beings is the night. This separation allows for a coordinated adaptation of the organism to either ergotropy or trophotropy. Additionally, the change of heart rate, hormone levels, and electrolytes, to mention just a few parameters varying during the circadian cycle, exposes the internal sensors to different systemic levels, recalibrating them and facilitating their autoregulative work.

The Body Works Like an Orchestra

Besides the circadian rhythm, chronobiology observes a notable amount of rhythms at all organismic levels and over several orders of time magnitude [5]–[7]. The rhythmic orchestra investigated up to now ranges from milliseconds of a nerve discharge to the annual rhythms of hibernation (Figure 1). Although circadian and long-term rhythms help to anticipate the environmental changes connected to the earthly and solar movements, the faster ultradian rhythms organize the interplay between different organ systems. There is a horizontal orchestration of body functions comparable to the themes of a symphony and a vertical orchestration comparable to the rhythmic interaction between different instruments in a music ensemble. Forty-eight octaves are available for the human organism, of which ten are audible to the human ear. Longer cycles of seven years can be found, for example, in the biography of celebrities like Goethe, who used to change the lady he adored with such clear periodicity. The occurrence of tooth change (~ 7 years), puberty (~ 14 years), and adolescence (~ 21 years) also follows such cyclicity. The whole life span, which is expected to be around 78 years for a subject born in United States in 2001, is the longest cycle observed in the human life.

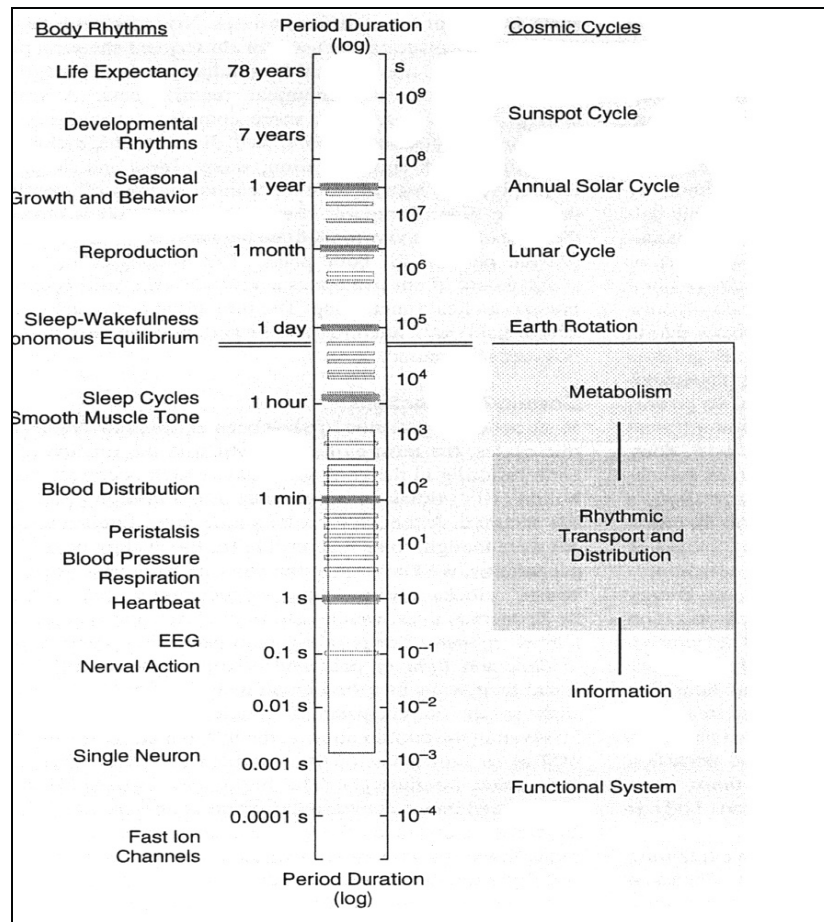


Fig. 1. Spectrum of biological rhythms identified in the human organism (modified after [5]). Chronobiology observes a notable amount of rhythms at all organismic levels and over several orders of time magnitude.

On the other end of the spectrum, very short periods of time, of microseconds, may be found in the clockwork of the receptor channels present on the surface of cells [8]. Musically speaking, 48 octaves can be counted from the frequency of a fast ion channel (29,000 Hz) to the average human lifetime (~ 78 years), which is about six times the range of a stage piano.

Recent investigations give hints that the different rhythms are interconnected, at least in healthy subjects, by phase coupling [9], synchronization [10]–[12], or mutual modulation [5], [13], [14]. As in a symphonic orchestra, different oscillators cooperate within and between cells and organs from plants [15] to man. The resulting time network supports organismic regulation and is an important pre-condition for the maintenance of normal development and health. Consequently, there is now increasing evidence that the destruction of the biological rhythms and their synchronization results in the loss of health.

The circadian rhythm itself shows up shortly after birth and becomes synchronized with the external day during the first 16–20 weeks of human life [16]. Toddlers exposed to a light-cycle program display improved growth and circadian entrainment when compared with those exposed to continuous dim or bright light [17], [18].

The terrestrial movement around the sun results in the geological year and is answered by a circannual cycle in organisms living under its influence. The period of the lunar cycle is possibly found in the female menstrual cycle, although today only some studies find a significant connection [19]–[21] most likely due to the light pollution present in urban societies, thus obscuring the lunar influence. In many traditional societies, social life during the year was organized in synchronicity with the lunar cycle [22].

As already mentioned, it seems favorable for the organism to orchestrate its functions in synchronicity with external conductors such as cosmic rhythms and also to synchronize the internal rhythms among themselves. This is the case in the circadian rhythms, which are synchronized with the external day and night by Zeitgebers, of which light [23], [24], feeding [10], and temperature [25] are the most important. The onset of light in the morning triggers a couple of hormonal reactions, which turn down the immune cell response, the readiness to sleep, and the production of growth hormone and melatonin [23]. On the other hand, heart rate, vigilance, the secretion of epinephrine, cortisol, and other hormones necessary for wakeful activities are turned up. It is easily understandable that this has to be done in synchronicity and coordination, otherwise the resulting chaos would allow for neither a vigilant day nor a restful sleep. Shorter rhythms than the circadian do not reflect cosmic cycles, although some authors claim a connection between body rhythms and solar events [26], some of which may display ultradian cycles.

The Body's Own Time Symphony

One of the most prominent cycles of short duration is the heartbeat, the period of which is modulated by and can be used to gain insight into a couple of other body cycles. This HRV is easily obtained noninvasively from a 24-h Holter ECG and mirrors the rhythmic activity of the vagal and sympathetic nervous systems controlling the action of the heart. The autonomic activity is always cyclic, generated by oscillators in the brain stem. As the autonomic modulation of the heart rate is proportional to sympathetic or vagal tone, information about the sympathicovagal balance can be extracted from the amplitude of heart rate variability, thus giving access to the state of the autonomic nervous system, which governs almost all body functions.

An impressive overview about rhythms present in a subject can be obtained by time-variant analysis of HRV. We have developed a special method to visualize these rhythms from longtime recordings of HRV [27], [28] (also see www.heartbalance.com). The resulting graph called an autochronic image (in Greek, *autos* means self or proprietary and *chronos* means time) is a portrait of the rhythms modulating and moving the beat of the most central organ of the body (Figure 2). This activity is also closely connected to our emotional state and state of consciousness, to work strain or relaxation (Figure 3). The autochronic image has since been used extensively in projects of occupational health promotion [29], shift work, and even space medicine [30], [31] to diagnose sleep quality and rhythm disturbances (Figures 4 and 5). The heart rate is synchronized with several other cycles, such as the respiratory cycle, the blood pressure rhythm, and the rhythm of peripheral circulation. This synchronization is especially strong during rest and relaxation and is not present if subjects are under increased stress and strain. These conditions do not allow for tuning and, consequently, spend more metabolic energy than the well-tuned sleep.

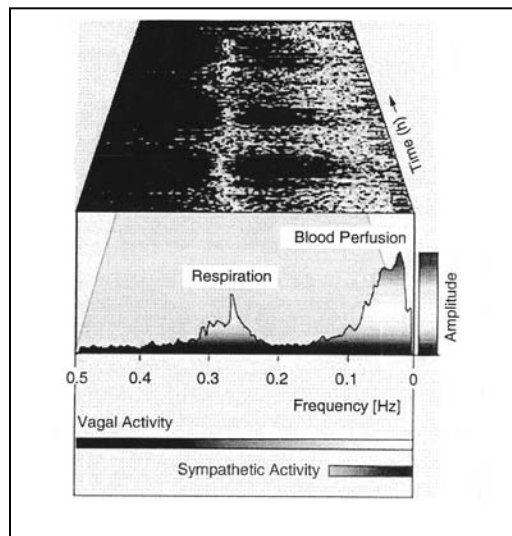


Fig. 2. Time-variant spectrogram of a multioscillatory biological rhythm, in this case HRV. After sampling beat to beat intervals with high accuracy (sampling frequency $\frac{1}{4}$ 4,000 Hz) for several hours, a moving Fourier transform is performed every 5 min. The resulting amplitude curves for each 5 min. are color-coded so that small amplitudes are blue, intermediate are white, and large amplitudes red at each given frequency. Put together, an image of the different rhythms becomes visible (autochronic image, upper part of the figure). Particular frequencies can be seen as lines running through the upper part of the image, and chaotically distributed autonomic activity is seen as visual noise in the image. The image shows several hours of HRV during different sleep stages.

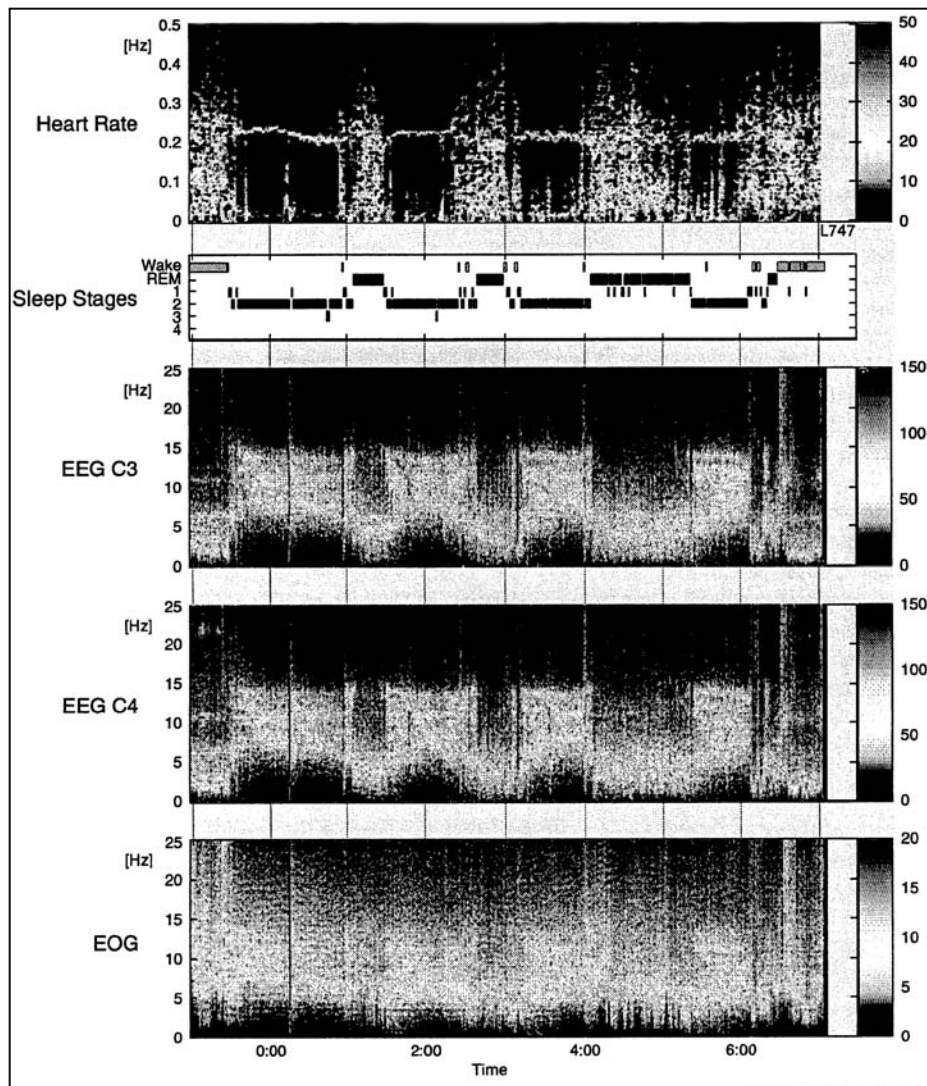


Fig. 3. HRV, sleep stages (classified according to Rechtschaffen and Kales), electroencephalogram (EEG C3 and C4), and electrooculogram (EOG; eye movements) during sleep, analyzed by time-variant spectral analysis (autochronic image, from top to bottom). Blue color indicates low, white color medium, and red color high amplitudes. Slow wave sleep stages in the EEG correspond to periods of intense respiratory sinus arrhythmia in the HRV (single lines in the upper trace), indicating a strong vagally transmitted heartbeat modulation by the respiration. Rapid eye movement stages are empty of rhythms in the EEG recordings and are characterized by chaotic HRV.

The orchestration of the rhythmic system has both a horizontal and a vertical aspect. Horizontally, rhythms such as the circadian conduct the sequences necessary for the daily activities at the time they are needed. This corresponds to the sequence of themes in a symphony. The temporal compartmentalization arising from this gesture permits oxidative and reductive reactions to run undisturbed alongside each other within the same spatial compartment. As mentioned, this has been investigated recently in yeast cells [1], [2], and the rhythmicity becomes most pronounced under nutrient-restricted conditions. Interestingly, nutrient restriction has

been found also to prolong life [32], [33], which finding strengthens the connection between rhythmicity, health, and longevity.

Vertically, rhythms such as heartbeat and respiration coordinate with each other to “give me five” (slap hands) every four or so cycles. In an orchestra, this would correspond to the rhythmic interaction present between different instruments during the play, e.g., the relation of the violins to the slow contrabass. The coordination can be a phase coupling, a mutual modulation, or a synchronization [9], [11]. The obtained synchronization obviously saves energy, such as clocks synchronizing their beats if mounted on the same wall [34], indicating that the synchronized state is the one with lower energy expenditure.

Rhythmic gene regulation is also important for normal embryonic development [35]. During development, time structures in gene expression and cell division are translated into spatial shape, which makes precise timing most crucial to translate the precise shape of the developing structures [36]. It appears reasonable, therefore, that abnormal development found in cancer cells might originate from disturbances of rhythms. Severely disturbed rhythms, have, in fact, been found in cancer patients, as should be expected.

Circadian Rhythm Disturbances in Cancer Patients

Circadian rhythms are disturbed in cancer patients, with regard to heart rate and HRV [37], [38]. Sleep quality is extremely reduced in cancer patients [39], which also hints at a disturbed circadian system [40].

In a study performed by our group in a German cancer clinic, it was especially the circadian profile of the sympathetically mediated low-frequency HRV around 0.1 Hz that differentiated between healthy subjects and all cancer patient groups [38]. Disturbances of biological rhythms can also be found in cancer cells and vessels supporting cancer tissue. Cancer cells divide rather slowly as long as their metabolism is limited and they are not connected to the circulation. The vascularization that makes cancer tissue really harmful is evoked by angiogenetic hormones secreted by certain cancer cells. These new vessels sprouting from normal vessels lack normal development and appear disorganized and chaotic due to their rapid growth [41], [42]. Smooth muscle cells in the vascular wall of these vessels are missing, so that they do not respond to the hormones regulating normal vessel diameter in a circadian profile. As there is no temporal restriction to growth, the connected cancer cells grow faster than normal cells. In addition, chaotic circadian temperature profiles can be observed [42] – [44]. The cancer tissues seem to be different in their rhythms from those of the rest of the organism. The resulting desynchronization weakens the circadian oscillation and decreases the amplitude of the circadian profile in cancer patients. As early as the 1980s, Bartsch and coworkers found a disturbed melatonin excretion in breast cancer patients, which was not synchronized with the circadian rhythm, compared with the synchronized patterns of

controls [45]. The circadian clock, representing the most intensively investigated rhythm, is increasingly recognized as an important tumor suppressor [46].

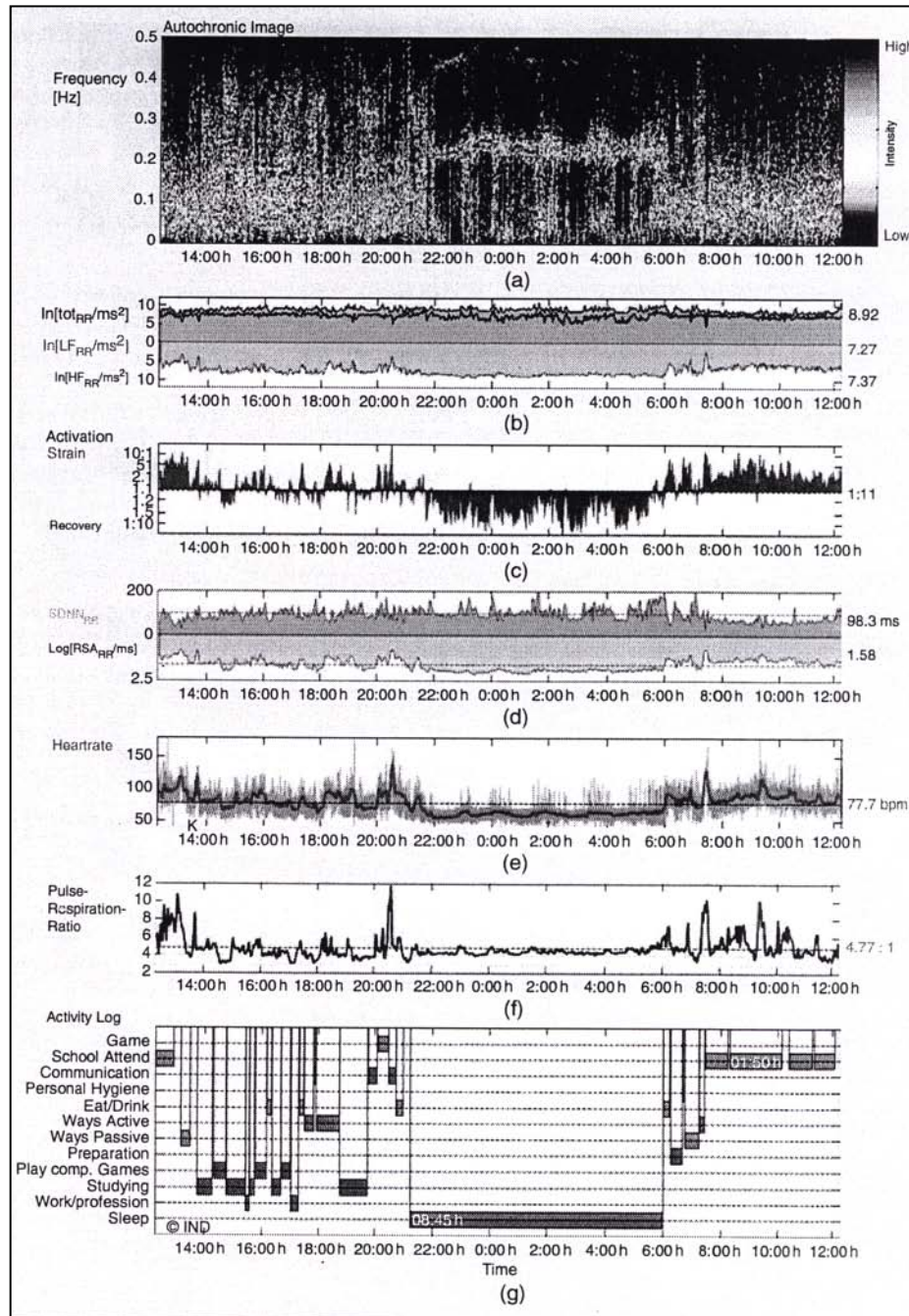


Fig. 4. Example of the multioscillatory rhythms of HRV in an 11-year-old boy not yet in puberty. During the day [(a), left and right], a strong variability indicating an active cardiovascular regulation is present. During the night [(a), center], a strong respiratory sinus arrhythmia is visible especially during quiet slow-wave sleep. Blue areas in the autonomic balance [(c), center] indicate a vagal predominance and a recreational sleep. Cardiorespiratory synchronization (4:1 ratio) is seen in the pulse-respiration quotient during the sleep (green line). The boy had a range of different activities according to his activity protocol and was well integrated in his family.

Ultradian Rhythms

Ultradian body rhythms oscillate faster than daily rhythms but are usually whole-number multiples of the circadian rhythms. One example is the basal rest and activity cycle, which controls deep and rapid eye movement phases of our sleep in an approximately 90-minute pattern corresponding to 16 cycles per day. These rhythms are phase coupled to the circadian rhythms in healthy subjects so that their ups and downs appear approximately at the same time each day. Short-period rhythms are present in the human circulation and permit the study of the possible benefits of oscillating parameters establishing homeodynamic [47] equilibria in the body. Blood pressure control was studied as early as the 1930s. The blood pressure loop was disconnected under experimental conditions, and a dependence between blood pressure and heart rate was found. Increasing the pressure in the carotid sinus (the location responsible for sensing the blood pressure value) leads to a compensatory reduction of heart rate via vagal pathways (Figure 6) in a classical experiment performed by Koch [48]. Along the range of different pressures, a sigmoidal shape of the resulting regulation curve was found. Interestingly, the steepest part or point of inflection of this regulation curve is located almost exactly where the normal systolic blood pressure was found at around 120 mm Hg. As physiological sensors adapt to each steady stimulus, the blood pressure regulation would shift and become unstable after a while, if no variation in the pressure occurred. A slight variation of the heart rate (which is found in the HRV mentioned previously) prevents this adaptation by a resulting continuous variability of blood pressure. Thus, the blood pressure regulation loop obtains the necessary feedback to estimate the amount of heart rate change required for a certain increase or decrease of blood pressure.

The small oscillations present in the organism support the self-calibration of the organismic functions. Blood pressure is therefore obviously not controlled by a single neuronal center, which sets the scheduled value to 120 mm Hg. It is rather the result of a democratically achieved regulation curve that integrates all relevant parameters, such as the elastic properties of vessels, blood volume, blood viscosity, and peripheral resistance. At the inflection point, the strongest interconnection between heart rate and blood pressure can be found, making regulation most sensitive close to this value and, hence, most stable for the circulation. Opting for a stable supply of blood and oxygen, it is not surprising that the organism shifts its normal blood pressure value to this turning point. This is especially the case under resting conditions, during which more regular oscillations with higher amplitudes occur. Under ergotropic conditions, the metabolic needs determine heart rate and blood pressure, and HRV becomes small or disappears as it loses its importance for regulation. Consequently, rhythms are found most often when the energy expenditure has to be minimized, which is during the economic and quiet periods of the night and during rest. There is a second instance where rhythms might occur especially in well-trained subjects.

Long time periods of equal exercise also do not supply changes of blood pressure necessary to prevent blood pressure drifts. Accordingly, rhythmic variations of heart rate can appear under these conditions.

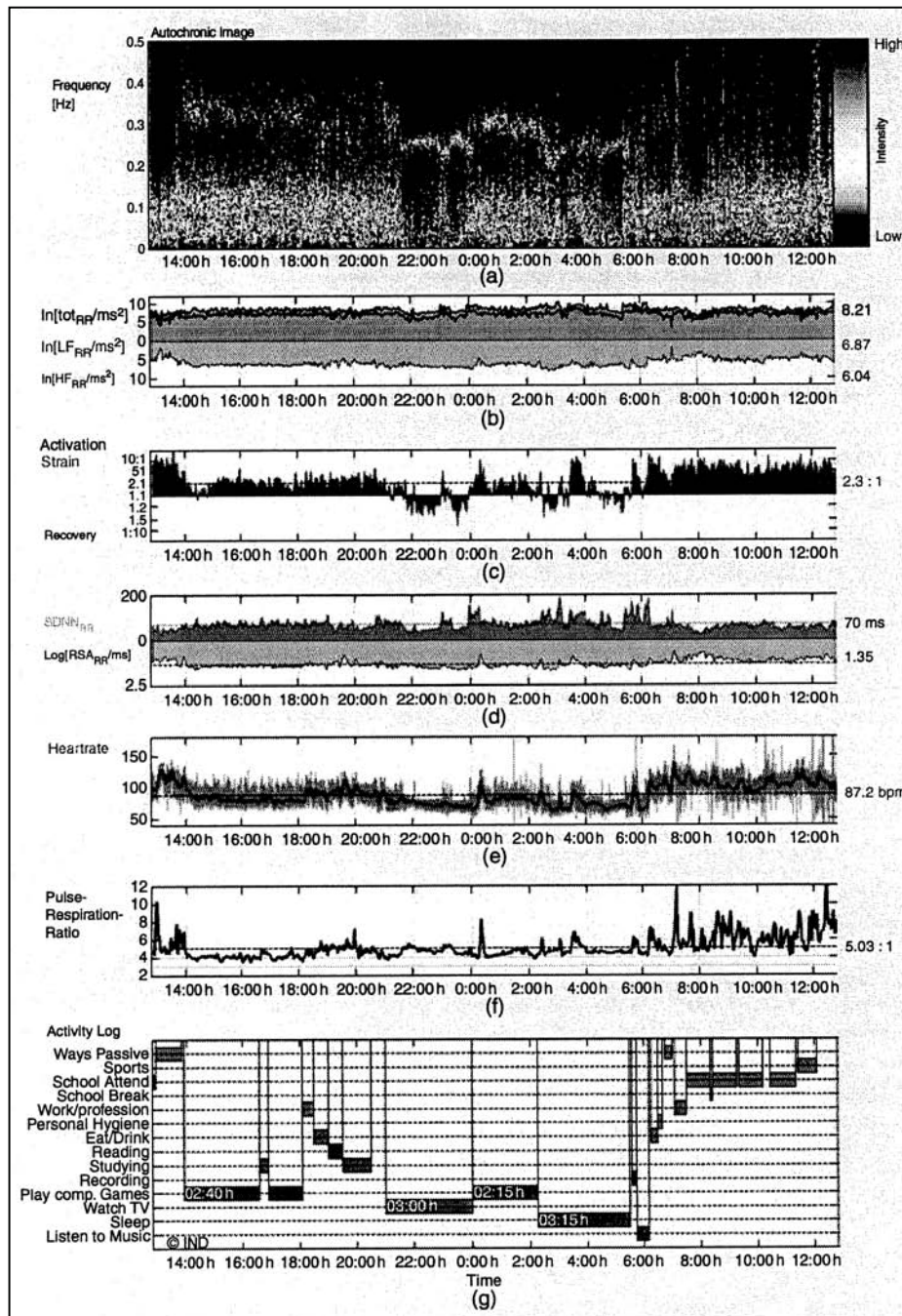


Fig. 5. The other boy from the same school was 14 years old and already in puberty. Disturbed and irregular rhythms during sleep can be observed. They are caused by extensive use of television 2100–000 h and computer games 1400–1800 h and 000–0200 h. Sleep quality is accordingly bad due to sympathetic predominance [(c), center], and cardiorespiratory synchronization is disturbed and irregular (green line). Such demonstrations of disturbed body rhythms can be understood after explanation and can be very helpful to motivate healthy behavior in occupational health projects (method available from www.heartbalance.com).

It is not yet known whether such sigmoid regulation curves such as the one shown in Figure 6 exist for hormones as well. Given the known pulsatile secretion of hormones, it seems very likely that other control loops are maintained in a similar fashion, again especially under conditions of rest, where the hormonal pulsing becomes most pronounced [49], [50]. Oscillations in this context obviously act as search functions seeking points of optimal regulation in our organism. Recent work has connected the decline of the dynamic range of environmental cues in modern societies to observed biological dysfunctions, such as insulin insensitivity and metabolic diseases [51]. A dynamic system lacking variability is more likely to lose its points of calibration.

Chronamins

If decreased rhythms are harmful, an enhancement of rhythmicity can be expected to improve organismic function. Modern life has restricted rhythmicity due to artificial light, controlled temperature, and restriction of outdoor activities. Like the lack of vitamins in modern food, rhythms are missing in modern life. This knowledge could help provide therapies based on chronamins [38] and lifestyle approaches providing dynamic environmental cues [51], [52]. In musical instruments, long-term stability of sound is achieved by playing, i.e., vibrating the instrument for a period of time. This stable state may even be mimicked by vibrating the instrument artificially [53]. In several studies not yet published in English, we found therapies based on art and rhythmicity that have been very successful in improving subjective as well as physiological sleep quality and well-being. Heart rates were lowered in the treated subjects, and autonomic circadian amplitude increased. In a company of 300 construction workers [29], the number of accidents dropped from 12% of workers per annum to zero. Sleep quality significantly improved only in the rhythm therapy group, whereas the control group treated just with simple gymnastics did not show this improvement.

As we are taking part in various revolutionary alternatives in our understanding of life, one of them might be based on the results of modern chronobiology. Like Andreas Vesalius, who so beautifully described the spatial

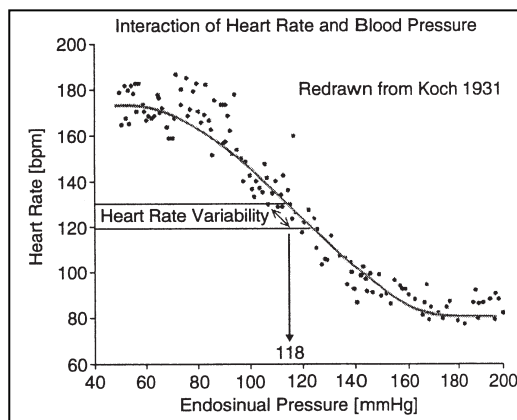


Fig. 6. Example of a physiological feedback loop with its normal value close to the point of inflection of the sigmoid system characteristics. The relationship between blood pressure in the carotid sinus and heart rate is shown. Heart rate variability very likely acts as a search parameter, varying continuously in search for the optimal position on the regulation curve. Regulation is most sensitive at the point of inflection, which also represents the normal value of systolic blood pressure (adapted from [48]).

aspects of our body, giving access to the anatomical shape of our muscles and bones [54], chronobiology is now dismantling the secrets of our hidden time shape. This is also interesting from a philosophical point of view, as natural science gains access to an area that is not physical matter, a substance, its concentration, energy, or even space—it is time and its biological structure. In a way, we are discovering what could be called an anatomy and a histology of time represented in the different rhythms acting in our body and the symphonic orchestra playing the tune of our life (Figure 6). This has consequences for an understanding of health and its maintenance. As early as the 1930s, the extract of the pineal gland, the source of the circadian hormone melatonin, was used as a remedy against cancer with surprising success [55]. Even today, melatonin contained in the pineal gland is considered to be helpful against certain tumors. There is strong evidence that the observed sleep quality improvement and beneficial immunological effects of melatonin [56] are present only if melatonin is administered in the evening [57], thereby also improving the amplitude of circadian rhythmicity. Many new achievements of applied chronobiology, such as the application of medication in a timed fashion, give us an inkling that, in future, medical professionals will increasingly utilize the human rhythms to support their therapies [58]. Playing in harmony with the body's orchestra is obviously not only more graceful and charming but also more effective than just playing.

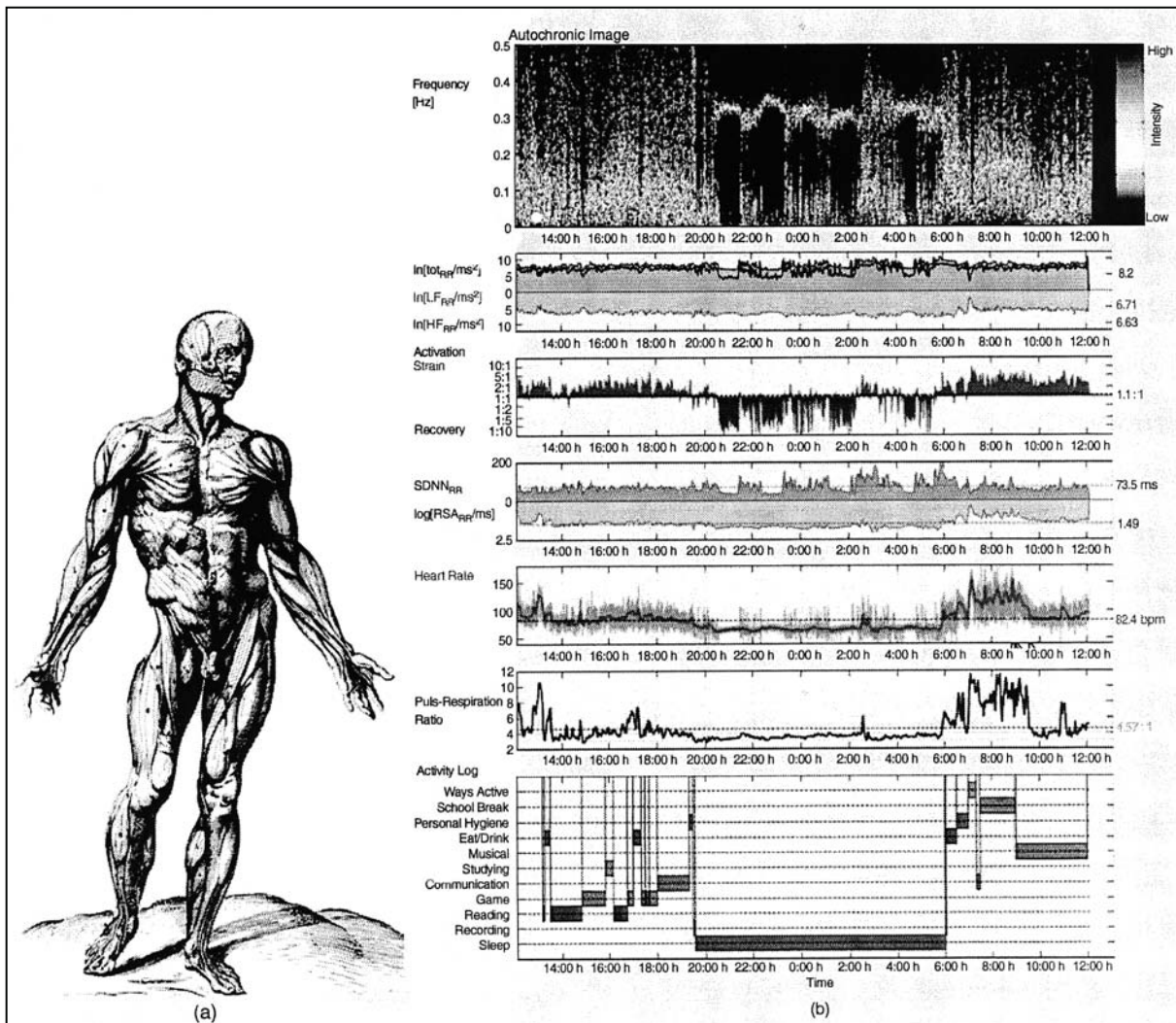


Fig. 7. (a) The physical anatomy of the human body has been described and investigated scientifically since the work of Andreas Vesalius. (b) Medical science has only recently become aware of the complex patterns of body rhythms accessible, e.g., by spectrogram analysis of long-term heart rate recordings (autochronic image). Body rhythms display distinct times of chaos (mainly during the day) and order (during well-slept nights). They are orchestrated horizontally, e.g., by the circadian clock, which conducts the temporal order of different organs, as well as vertically, by the rhythmic interaction of parameters such as respiration and circulation. These become visible in the 4:1 integer ratio of the pulse-respiration quotient [(b), green line] achieved during sleep and during periods of rest [(a) from [54]].

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OBSERVATIONS ON NEUROLOGICAL DEVELOPMENT

collected by

David S. Mitchell

While preparing for a workshop on “Will-Developed Intelligence” for the 8th World Teachers’ Conference at the Goetheanum in Dornach, Switzerland, I happened upon the following observations concerning neurological development.

What is normal neurological development?

From birth to adulthood, children grow physically and develop capacities. Normal development follows a standard orderly sequence of events which can be measured. Along the path of development are critical stages called ‘milestones’ or ‘ego awakenings,’ which are important developmental achievements such as prehensility, uprightness, and speech.



Every action of the hand and the eye sculpts the soul. Piaget called the process accommodation, the development of new cognitive structures.

– Arthur Zajonc
Professor of Physics
Amherst College

I would argue that any theory of human intelligence which ignores the interdependence of the hand and brain function, the historic origins of that relationship, or the impact of that history on the developmental dynamics in modern humans, is grossly misleading and sterile.

– Dr. Frank Wilson, *The Hand*

The density of nerve endings in our fingertips is enormous. Their discrimination is almost as good as that of our eyes. If we don't use our fingers, if in childhood and youth we become "finger-blind," this rich network of nerves is impoverished—which represents a huge loss to the brain and thwarts the individual's all-round development. Such damage may be likened to blindness itself. Perhaps worse, while a blind person may simply not be able to find this or that object, the finger-blind cannot understand its inner meaning and value.

If we neglect to develop and train our children's fingers and the creative form-building capacity of their hand muscles, then we neglect to develop their understanding of the unity of things; we thwart their aesthetic and creative powers.

Those who shaped our age-old traditions always understood this. But today, Western civilization, an information-obsessed society that overvalues science and undervalues true worth, has forgotten it all. We are "value-damaged."

The philosophy of our upbringing is science-centered, and our schools are programmed toward that end. ...These schools have no time for the creative potential of the nimble fingers and hand, and that arrests the all-round development of our children—and of the whole community.

– Matti Bergstrom, professor and
neurophysiologist from Sweden

The human being shares the ability to move with animals, but whereas animals learn the movements they require more or less at birth - the human being needs several years' practice to develop all the movements required to enable him/her to walk in an upright position.

The newborn infant expresses a multitude of movements, of which he/she is not yet master. Control comes from above to below—eyes to legs and feet. Movement at first takes hold of the child from the outside as it were, and limb movements are only gradually mastered.

The primal reflexes are developed by imitation towards individualized mastery of movement patterns. Attaining uprightness and making those first tentative steps are, however, only the beginning. The expression of movement in the child leads on to other faculties in the realm of the soul. Crawling, walking and all manner of bodily movements lay the foundation for the acquisition of many finer skills: Speech and, ultimately, thinking processes are realized as a result of the internalization of outer movement habits.

– Dr. Peter Engel

When personal desire prompts anyone to learn to do something well with the hands, an extremely complicated process is initiated that endows the work with a powerful emotional charge.

People are changed, significantly and irreversibly, it seems, when movement, thought, and feeling fuse during the active, long-term pursuit of personal goals.

– Dr. Frank Wilson, *The Hand*

Well-developed thought arises as the verbal behavior of the child undergoes a long metamorphosis during which words, which were originally object attributes, come increasingly to be manipulated and combined, just as real objects are manipulated and combined by the child.

– Lev Semenovich Vigotsky
Russian linguist

New research from the Child & Family Research Institute has shown that the typical North American diet (think meat and potatoes) is deficient in omega-3 fatty acids. This information is especially important to pregnant and nursing women since the deficiency may pose a risk to infant neurological development.

– Amy Gates

A study recently published in an August edition of Medical Hypotheses found that music therapy can often benefit patients with neuropsychiatric disorders caused by a traumatic brain injury accident. According to researchers at the Beth Israel Deaconess Medical Center in Boston, “the brain grows in response to musical training in the way a muscle responds to exercise.”

– Medical Hypotheses
September 30, 2008

Breastfeeding boosts neurological development. Science News reports on research that suggests that breastfed babies show measurable benefits in terms of action control and coordination. The coordination of movement relies heavily on good general brain function. If you ever visit a neurologist for a neurological examination, you’ll notice the majority of tests are to do with balance, muscle tone, movement and reflexes. Hence, the examination of these functions can give a clue to how well the brain is developing. A research team led by Dr Amanda Sacker set out to use these sorts of tests to compare how breastfed and non-breastfed babies were developing. To the researchers’ surprise, [research collaborator] Kelly noted that children “were about 50 percent less likely to have a [developmental] delay if they had prolonged, exclusive breastfeeding when compared to those who were never breastfed.” They defined breastfeeding as prolonged when it had lasted at least 4 months. Even babies receiving mother’s milk for a short while—2 months or less—were 30 percent less likely to have a developmental delay

than those who received solely infant formula beginning right after birth. The same team also recently reported results from another study that suggests that breastfeeding is linked to resilience in the face of psychological stress.

– Science News

http://sciencenews.org/view/generic/id/7765/title/Babies_MotorBetter_with_Breast_Milk

The lens of our eye turns the world upside-down and backwards onto our retinas. Learning to read requires first learning to see right-side up and frontwards.

Human vision relies on the brain's translating the light distorted by lenses and retinas, and this translation must be learned. The earliest visual task for children is learning to focus, followed by learning to recognize shape, orientation, depth perception and color. Everything we see starts out upside- down and backwards and requires comprehension to make sense. While it feels natural to read print right-side up and forward, it is familiarity, not natural.

Our developed, learned ability to report back data apparently right-side up and “correctly” left to right is the result of neurological pathways we’ve established between our left and right hemispheres of the brain. Until our neurons have done their traveling, any effort of any ostensibly well-meaning teacher to insist that a child not reverse and upside down his writing is wasting effort like unto insisting a six-month-old baby stop being so lazy and step up and walk.

Just as children learn which way gravity works, they will readily (in their own time, according to their neurological development and personal interest) pick up how letters are correctly formed.

– Linda Clement

*Learning to Read and How Human
Brains “See”*

Harvard Medical School affiliate Beth Israel Deaconess Medical Center in Boston reported that walking patterns open windows to neurological development. Kids seem to lose their wobbly walks by age 3, but a study from Beth Israel Deaconess shows that even healthy 7-year-olds do not have a completely mature stride. By age 14, a child walks almost like an adult, according to a report published recently in the Journal of Applied Physiology.”

For the study, BI-Deaconess researcher Jeffrey Hausdorff, PhD, and his colleagues analyzed the stride rhythms of 50 boys and girls as they walked around a track at a summer day camp. Special shoe inserts timed the subtle variations in each stride.

In earlier work on stride rhythm, the researchers had discovered that gait possesses a surprising mathematical property. The apparently random stride-to-stride fluctuations in gait actually have a “fractal” order to them. In healthy older adults, they soon found, the fractal nature of gait changes with age.

Subtle variations in gait patterns may offer a quantitative window into neurological development and its subsequent decline with age and pathology. “In terms of clinical applications,” Hausdorff says, “the results suggest that measures of gait dynamics may be useful in augmenting early detection and classification of gait and other disorders in children and adults.”

– Beth Israel Deaconess
Medical Center

Until recently, the prevailing belief was that brain development ceased at around the time a child entered kindergarten (i.e., that the brain is 90 to 95% formed by age six). However, recent findings indicate that the maturation of the prefrontal cortex, the region of the brain involved in critical thinking and decision making, is not complete until early adulthood (e.g., Casey et al. 2000; Luna and Sweeney 2004; Thompson et al. 2000). The brain grows, as evidenced by the thickening of gray matter, until about puberty (approximately 11 for girls and approximately 12 for boys), at which point the brain begins a process of thinning where unused neural connections are eliminated (Giedd et al. 1999; Gogtay et al. 2004). The thinning process continues into early adulthood and results in increased speed and enhanced information processing (Giedd et al. 1999; Sowell et al. 1999). During the thinning process, synapses associated with redundant connections and skills that remain untapped begin to be pruned or discarded (i.e., the “use it or lose it” principle; Durston et al. 2001; Gogtay et al. 2004). More specifically, pruning of synapses results in an enhanced ability of distinct regions of the brain (those that have been extensively utilized) to sustain high-level cognitive control of behavior (Luna and Sweeney 2004).

In addition to the thinning process, adolescent brain maturation is also characterized by myelination, which is the insulation of established neural connections and serves to optimize transfer of neural information across the central nervous system (Geidd et al. 1999; Yakovlev and Lecours 1967). An increase in myelination allows for increased response speed and improved integration of neural circuitry necessary in modulation of behavior (Geidd et al. 1999; Yakovlev and Lecours 1967). Adolescent structural brain maturation has important implications for adolescent development because parallel improvements have been found in several cognitive processes, such as problem solving, reasoning, working memory, response inhibition, and attention allocation (Anderson et al. 2001; Diamond 1988; Fuster 1989). These processes are important in the development of higher order functions such as mood regulation, decision making, and impulse control (Gogtay

et al. 2004). Adolescent brain maturation may therefore facilitate the acquisition of a more sophisticated cognitive and perceptual understanding of the adolescent's environment (Chambers et al. 2003).

- Neurological Behavior in Adolescence
[http://www.medscape.com/
viewarticle/573211_4](http://www.medscape.com/viewarticle/573211_4)

“Had the creators of No Child Left Behind looked at the data, they would’ve realized that physical activity is good for the brain,” said Charles H. Hillman, an associate professor of kinesiology at the University of Illinois at Urbana-Champaign. Mr. Hillman assessed the physical-fitness levels of 239 3rd and 5th graders from four Illinois elementary schools. His findings, published last year in the Journal of Sport & Exercise Psychology, show that children who got good marks on two measures of physical fitness—those that gauge aerobic fitness and body-mass index—tended also to have higher scores on state exams in reading and mathematics. That relationship also held true regardless of children’s gender or socioeconomic differences.

- Debra Viadero
“Case grows stronger for physical
activity’s link to improved brain function”

Exercise prompts the brain to produce greater amounts of a protein called brain-derived neurotrophic factor or BDNF, which stimulates the brain. It encourages brain cells to sprout synapses, which are crucial to forming the connections the brain needs to make in order to learn. It also strengthens cells and protects them from dying out.

Other research also suggests that exercise plays a role in neurogenesis, the production of new brain cells in middle-aged and older adults and in laboratory animals.

- Dr. John Ratey
Medical researcher
Harvard University

School children perform better at math when they use their hands to express themselves. In a recent research on 176 third and fourth graders to evaluate the cognitive benefits of gesturing, she divided the students into three groups— one group was told to gesture, one not to gesture, and the third was given no instructions either way. All were given six math problems to solve. The students encouraged to use their hands proved four times more likely than those given no instructions to manually express new ways to solve problems.

And after a math lesson, the gesturing students calculated correct answers 50 percent more problems than those asked to keep their hands still.

– Susan Goldin-Meadow
Psychologist
Northwestern University

It is generally known (back to medieval or ancient times) that deprivation of sensory stimuli like voice and vision in the early phases of human life will cause irreversible mental retardation in the child. Also the prevention of child play will cause intellectual deficits in the adult. But eyes, ears and nose are not the only human sensory systems. Additionally there are the two body sensor systems, the “somatosensors.” One is the vestibular sensor for maintaining orientation and upright walk. The other one is the skin, for sensing touch.

Through the work of James W. Prescott, PhD, and various others in the mid 1970s, it was established that these previously neglected senses are of overwhelming importance for the development of social abilities for adult life. Their deprivation in childhood is a major cause for adult violence.

– International Chiropractic Pediatric
Association
[http://www.icpa4kids.org/research/
articles/birth/Movement_in_
InfantNeurological_Development.htm](http://www.icpa4kids.org/research/articles/birth/Movement_in_InfantNeurological_Development.htm)

The primal reflexes are developed by imitation towards individualized mastery of movement patterns. Attaining uprightness and making those first tentative steps are, however, only the beginning. The expression of movement in the child leads on to other faculties in the realm of the soul. Crawling, walking and all manner of bodily movements lay the foundation for the acquisition of many finer skills: Speech and, ultimately, thinking processes are realized as a result of the internalization of outer movement habits.

The movements entered into in precision sequences, such as handwork and craft activities, are, similarly, more than training in motor skills. In the practice of work movements, which would be better described collectively as ‘work gesture,’ the will of the pupil and student of the craft is made subject to a greater governing order. It is in the very nature of this process that the character of the gesture works inwards to foster the unfolding and harmonious development of cognition, aesthetic sensibility and practical know-how.

The vehicle for this two-way process is what I call ‘work gesture,’ and is particularly evident in the movements of a well practiced craftsman. When

acquired, these movements play upon the soul of the human being, giving a beat in the sphere of 'will,' rhythm in the sphere of heart and 'feelings,' and a melody in the 'thinking' human being. This is the effect of the 'being of movement' and its resonance within the soul of the human being.

Each craft has its own symphony of working gestures, but as important to the acquisition of the actual skills, such as hammering/planing, is the realization of the point of rest and of the complementary gesture.

– Bernard Graves
Hiram Trust

Let us take into account that the whole education and instruction touches the whole human being. This can be done if the instruction comes out as a whole from the hearts of the teachers. It will become noticeable when the instruction flows from the soul element into the physical and practical. And this flowing into the physical and practical is the main concern of the Waldorf School. We try to let the children use their hands more and more. We work upward from the way in which the young child uses her hands in play to a certain artistic element, which is also taken out of the child herself.

This is accomplished by beginning in the sixth grade with the artistic side. Many of these things belong to an earlier age, but we are forced to make compromises. We won't be able to attain the ideal until later. Then a nine-year-old will be able to do the things also in the practical field now done by the eleven- and twelve-year-olds. But these practical things are characterized by free work and inclusion of the artistic. The child must work out of her will, not by following commands. Thus, we can bring the children to the point where they will carve and make various objects according to their own ideas. ... The fact that one has produced this or that box or bound this or that book is not important; what is essential is that one has gone through the process demanded in their execution—that one has experienced the feelings, the thought-processes in their practical doing.

– Rudolf Steiner

SEVEN “MYTHS” ABOUT THE SOCIAL PARTICIPATION OF WALDORF GRADUATES

by

Wanda Ribeiro and Juan Pablo de Jesus Pereira
São Paulo, Brazil

1. Introduction

Waldorf education continues to be relatively unknown. When first making contact with this pedagogy, people in general tend to find in it certain oddities that may provoke admiration or incredulity, as well as sometimes doubts.

Parents who decide to send their children to a Waldorf school know that they are taking a courageous step to be “different.” The decision is not easy, because Waldorf education really presents many differences in comparison with other teaching methods. Here are some of the most obvious ones:

- No text books are used; students create their own.
- There are no tests and no exams.
- There is no failing of a grade.
- Reading and writing begin only in first grade and may take a while to learn.
- All students remain grouped together from the first to the last (twelfth) grade (with occasional exceptions due to students entering or leaving the school).
- There is a teacher, called a “class teacher,” who takes a class in grade 1 and ideally stays with the class until grade 8, teaching all the main subjects: mathematics, history, geography, the native language and sciences;
- These main subjects are taught in “main lessons,” daily classes which run over three or four weeks;
- Ideally, students learn sciences such as physics, biology, chemistry and geology, using the so-called “Goethean phenomenological principle.” This means that first of all they

- intensely experience and describe the related phenomena, and only later come to learn and elaborate intellectual concepts about them.
- Arts have the same importance and receive the same attention as all other school subjects; this means that they are not organized as extra classes or elective subjects. They include form-drawing, sketching, painting, sculpture, pottery, weaving, music, drama and handicrafts. Furthermore, in the elementary and middle schools (grades 1- 8) every subject is taught in an artistic way.
 - Waldorf education is based on the anthroposophical concepts and an understanding of the human being developed by Rudolf Steiner at the beginning of the 20th century, particularly with regard to concepts involving the processes of child and adolescent development. The content of each school subject and the way the subject is taught follow specific concepts about the characteristics of each age level.

In Brazil and many other countries, many doubts arise when people first hear about Waldorf education because these and other aspects lie far away from what they are used to finding in conventional schools. Some of these concerns have to do with the imagined difficulties graduates may meet when pursuing a higher education in good universities, their perceived tendency to stick to professions connected to the human sciences and the arts, their ability to later succeed in the job market, etc.

The authors of this study were confronted with similar questions and doubts. Their daughter Renata presently attends class 10 at the Rudolf Steiner Waldorf School of São Paulo (RSWS) in Brazil (Escola Waldorf Rudolf Steiner de São Paulo). Some years ago, when they first learned about Waldorf education, Juan Pablo's reaction was a feeling that he had somehow found a place for his child where human beings could be well prepared to later act in the "real world." Wanda, on the contrary, experienced many doubts. She thought that Waldorf education was interesting enough, but unfortunately "far away from reality."

In 2001, when Renata was nine years old and after trying "conventional" schools, they decided on Waldorf education. Later on, Wanda had no more doubts about the excellence of this method. Nevertheless, when they began to meet other parents in that Waldorf school, the authors were surprised to find other parents struggling with the same old doubts that Wanda had once had, and which the majority of people outside the school usually have. So they felt the need to objectively clarify such doubts and verify whether they correspond to some reality, or whether they were simply "myths." (In this paper, "myths" will be referred to as the phenomenon described in the *American Heritage Dictionary, 3rd Edition* with the following words: "A fiction, or half-truth, especially one that forms part of an ideology.")

Resorting to Wanda's experience as a social scientist, they decided to begin with a statistical data research project. Furthermore, this was an

opportunity for Wanda to examine several other aspects that had attracted her interest when she first learned about Waldorf education. Juan Pablo decided to collaborate in the study in order to collect “serious” arguments when talking about Waldorf.

The research started in August 2003 and was based on interviews of Waldorf graduates, who are the real actors in this process and the only people in a position to bring truth and light to all these speculations and “myths.” The results brought answers to many questions and a lot of information on Waldorf education itself. This paper presents some of the statistical results collected in the interviews. Of course, numbers alone can hardly express the essentials of what was learned in this study or what Waldorf education really is, but they can surely shed some objective light on common doubts.

This research is not a pedagogical work: There are no discussions about education theories and approaches. It is a sociological work, which investigates the results of the application of Waldorf education. This is what will be here called “social participation.”

2. Methodology

The field of investigation was the Rudolf Steiner Waldorf School of São Paulo (RSWS) for the following reasons: first, it is necessary to locate a piece of research in a specific time and place; second, the school has a large enough cohort of graduates to provide a reliable base for a statistical sample; third, this was the pioneer school in the application of Waldorf education in Brazil; fourth, it has graduates covering a wide range of ages, providing for a wide view of the aspects the research wanted to explore. 135 graduates of the school were interviewed during the period 2003 to 2006. For this first research the authors considered just those who had finished high school at the RSWS, comprising a total of 108 who graduated between 1975 to 2002. This period was chosen because 1975 was the year of the first high school graduation, and 2002 because it was found important that some distance be left from the year of graduation for the analysis of social participation. The number of 108 students represents a statistical sample with 95% confidence, with an error margin of 10%.

During the period 1975–2002 the school graduated 1,345 students, according to its own records. Subjects to be interviewed were chosen sometimes on the basis of recommendation by people outside the school, sometimes by other former students, or by randomly selecting participants of the school’s Alumni Association (GEA, for *Grupo de Ex-alunos Waldorf*) particularly during its 2003 and 2004 annual meetings.

The authors designed a questionnaire with “open questions.” This means that the interviewees could say anything they wished. There were no pre-determined answers to be chosen. We present here only quantitative results of this first research. Qualitative elements will be presented elsewhere, and will constitute an outcome of the main goal: showing the distinguishing characteristics of a Waldorf school from a qualitative point of view. 35

questions were designed with the goal of clarifying many aspects, some of them not included in this paper, such as the students' relationship with their class teachers, their opinions about watching TV, their comments about people with whom they work, and so on.

In 82% of the cases, interviews were personally made, recorded and transcribed afterwards. During the interviews the authors wanted to apply a basic principle of Waldorf education, i.e. having a personal contact with each subject. Only 11% of the interviews were conducted by telephone and 7% by e-mail. The authors planned an investigation about Waldorf education, and not about the RSWS. This means that the same questions can be applied to any Waldorf school. Furthermore, this research does not compare Waldorf education with other pedagogical systems.

The questions helped to make an assessment of what the authors call "seven myths about Waldorf education," detailing and expanding the doubts referred to in section 1. These myths are as follows:

1. Waldorf graduates are not able to pass the admission examinations to Brazilian colleges and universities (called *Exames vestibulares* in Brazil).¹
2. They are not admitted to first-rank colleges and universities.
3. Once accepted by a good college or university, they are not able to finish their course.
4. Most Waldorf graduates become artists.
5. Waldorf education does not prepare its students for the job market.
6. It does not prepare its students to be professionally competitive.
7. Waldorf is a religious education.

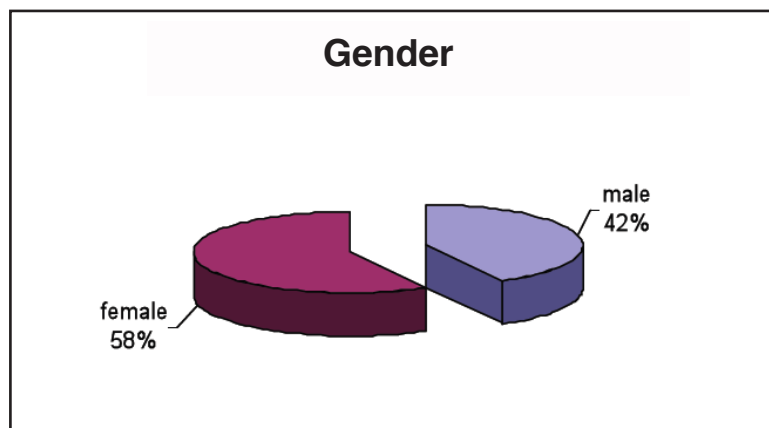
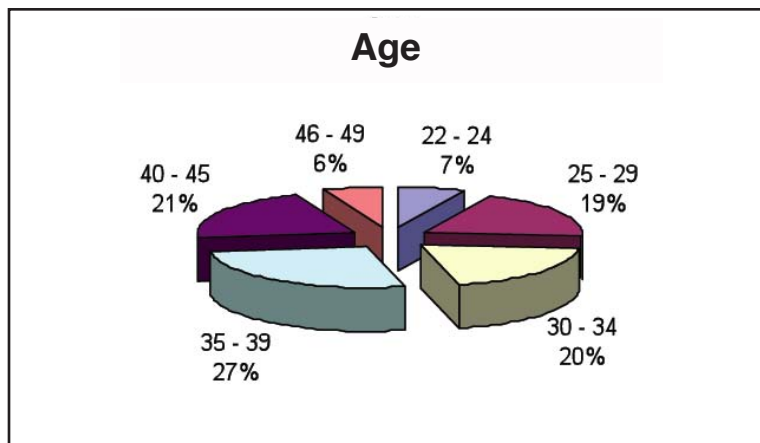
These myths summarize just some of several common prejudices about Waldorf education in Brazil;² they constitute what seem to the authors to be the most frequently expressed and typical doubts about the education.

3. Outline of the sample

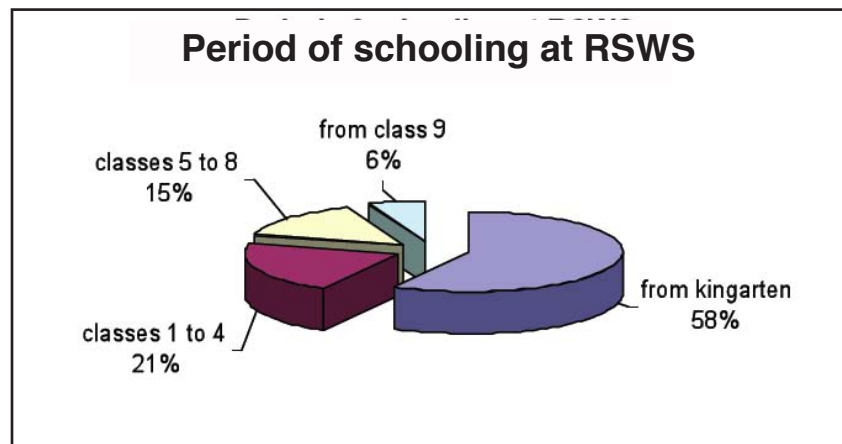
At first some quantitative aspects about the graduates who were interviewed are shown. The graphs below show the distributions according to age and sex.

1. These examinations, given by each college, university or group thereof, are considered of extreme importance in Brazil because passing the examination and getting a sufficiently good mark in order to be offered one of the limited number of available places is the only way a student can be admitted to a college or university.

2. The website of the Association of Waldorf Schools of North America shows some "frequently asked questions" (FAQs, see www.awsna.org/awsna-faq.html); some of our "myths" are there. There is a video made by Freunde der Waldorfschulen ("Friends of Waldorf Education") for the 44th International UNESCO Conference on Education, which took place in Geneva, where some of the same doubts are expressed by parents.



It is interesting to note that our sample had about the same distribution of gender as the total number of graduates of the RSWs. The next graph shows the classes in which the interviewed people had begun their schooling at that school.

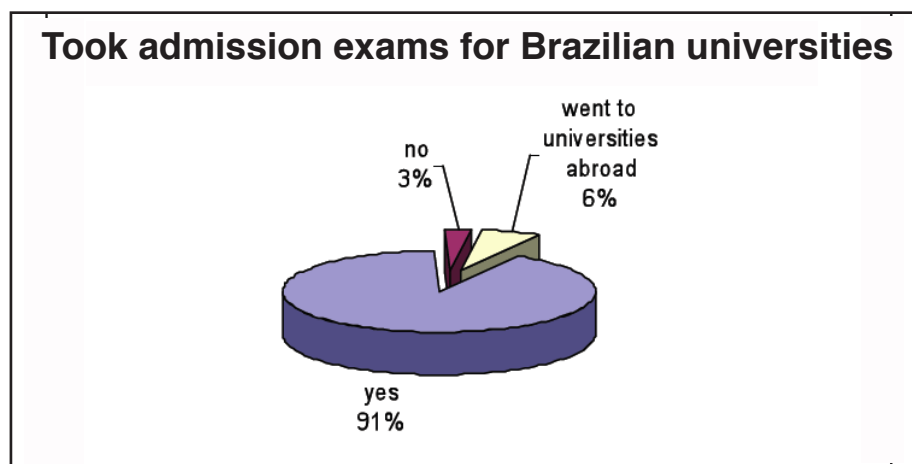


This graph shows that 58% did their whole schooling at the school, 36% came into the school in elementary or middle school, and 6% came into high school; all of the latter came from “conventional” schools. It is interesting to call attention to the fact that for many years RSWS was the only Waldorf school in the city of São Paulo (in fact, in Brazil) with a high school.

It is also interesting to note that graduates who entered the school in the upper classes said that their own opinion was fundamental to this decision. They said they looked for a “different” education.

4. Assessment of the seven myths

4.1 Myth number one: Waldorf graduates are not able to pass admission examinations to Brazilian colleges and universities.



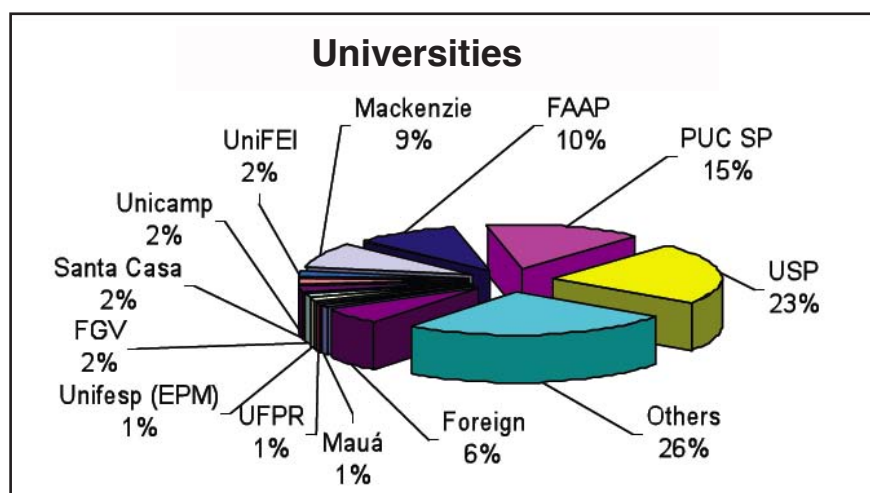
Not all graduates tried to follow a university course. The next graph shows the percentage of those who did. 100% of the students who took admission examinations to colleges and universities passed them. This shows something very significant in terms of academic achievement. There are many private high schools that specialize in preparing their students to take admission exams to universities; this is done, for example, by separating classes into various vocational streams (because of differences in subjects and difficulties tested in those exams)—such as the physical sciences, maths/computer science and engineering, biological and medical sciences, law, etc.—and directing teaching to the programs of admission exams. No Waldorf school in Brazil has a curriculum with this goal: All of them provide for a general education. Nevertheless, the results of graduates in the admission exams to colleges and universities were absolutely exceptional. One has also to understand that certainly many Waldorf graduates take 1-semester or 1-year preparatory courses for those exams after graduating from school, but the end-effect shows that Waldorf education does not hinder going to a university, on the contrary, as the only 3% that did not pursue a university degree show.

This study showed another, very significant piece of information: 91% of those interviewed who did take admission exams were admitted into a university on their first attempt, 8% on the second attempt and only 1% after the third attempt. It should also be noted that very rarely does a student in class 12 take a preparatory course in parallel to attending school, because the curriculum of class 12 is very demanding. As a matter of fact, 21% of the interviewed graduates passed admission examinations to universities without going to preparatory courses, which is also a very high percentage in comparison to preparatory high schools.

4.2 Myth number two: Graduates are not admitted to first-rank colleges and universities.

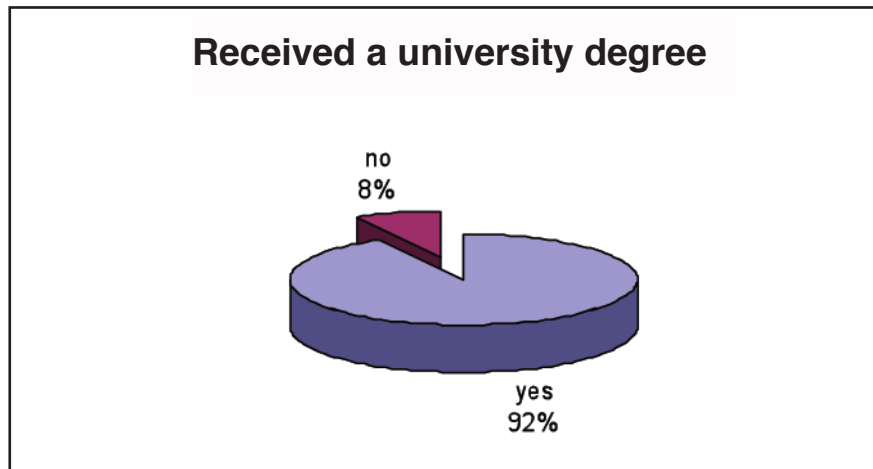
This myth is a consequence of the previous one. In the authors' experience, after telling someone that graduates did very well in admission exams, they would immediately be confronted with the statement that the students were probably not able to enter a good university. Therefore, they decided to investigate the institutions that were attended. The next graph shows in detail universities and colleges that are ranked as good ones by the Brazilian Ministry of Education.

In the graph below, USP stands for "University of São Paulo," by far the most scientifically productive in the country, ranked among the best 150 in the world; PUC/SP stands for the Catholic University of São Paulo; E.P.M. (Escola Paulista de Medicina) and Santa Casa rank among the main faculties of medicine in the country, etc. "Others" stands for universities and colleges not so well ranked. So, it is possible to see that 68% of all graduates went to very good institutions.



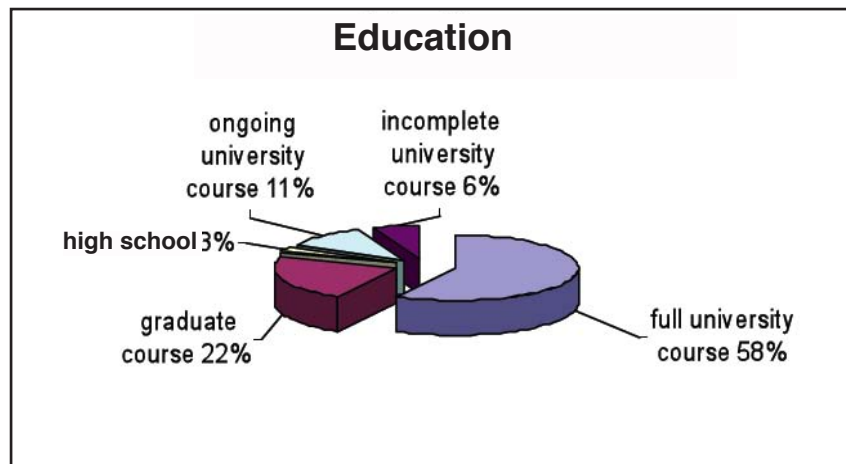
4.3 Myth number three: Graduates are not able to finish their university courses.

Another common statement is: “If Waldorf graduates pass the admission exams to universities, they are not able to finish them successfully.” The next graph shows the percentage of Waldorf students who finished their higher education, getting a college or university degree.



The next graph completes the preceding one, showing with more detail the educational grade attained by Waldorf graduates.

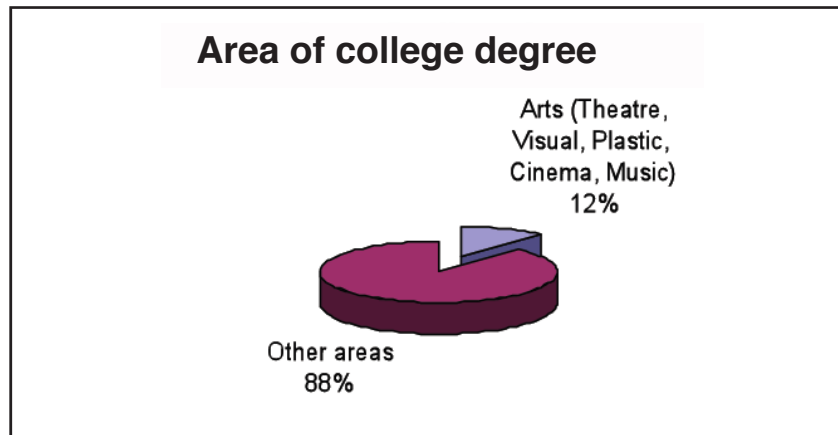
This graph shows that 80% of Waldorf graduates successfully finished university; one should also take into consideration the 11% who were still attending university at the time of the assessment.



4.4 Myth number four: Most Waldorf graduates become artists.

As Waldorf education gives the same importance to artistic subjects as it gives to traditional academic subjects, besides using artistic means for teaching every subject in elementary and middle school, people think that the education just produces artists. The first graph shows the choice

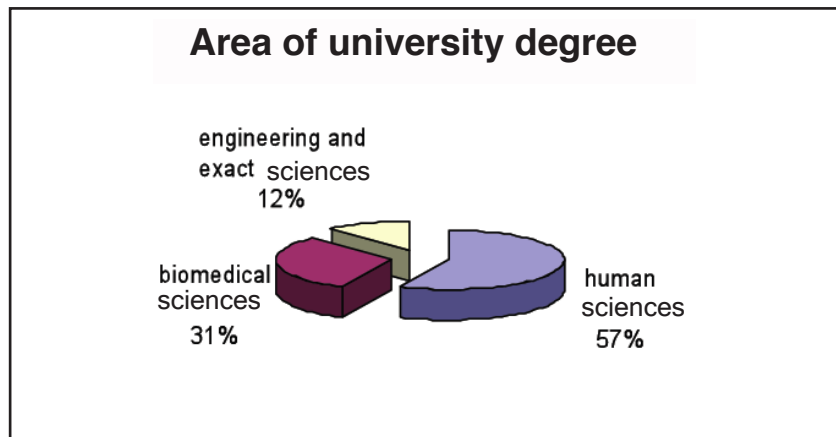
of Waldorf graduates in various college areas, separating the artistic ones (theatre, the plastic arts, visual arts, cinema and music).



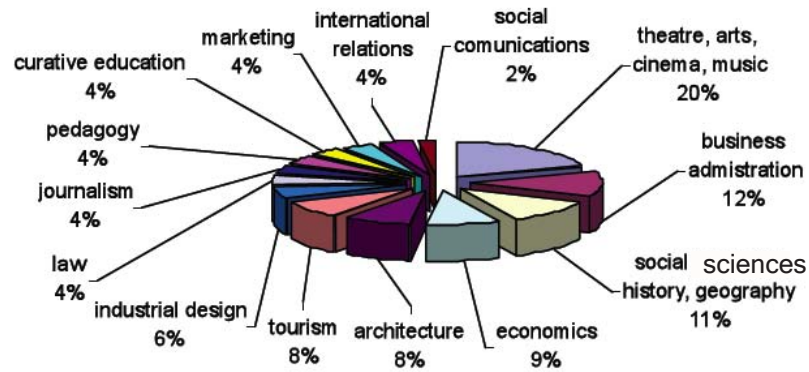
The above graph shows the areas of college degrees subdivided among biomedical, engineering/exact and human sciences areas (these are areas used in Brazil for large admission exams to universities, such as Fuvest (USP along with some other independent faculties) and Vunesp, the two admission exams in Brazil with the largest number of candidates).

It is interesting to compare this distribution of candidates with the overall distribution of candidates who took the two admission examinations cited above: 50% for human sciences, 30% biomedical and 20% engineering/exact sciences. This contradicts the common myth that Waldorf graduates tend towards the human sciences.

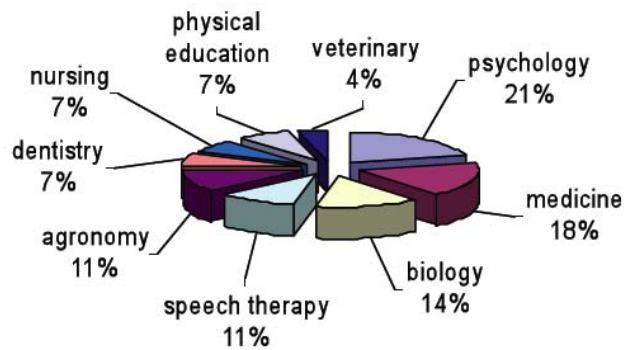
The following graphs show details of these three areas in corresponding sub-areas.



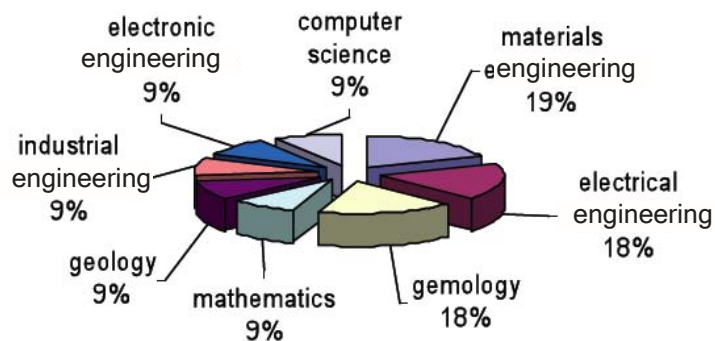
Human sciences



Biomedical sciences

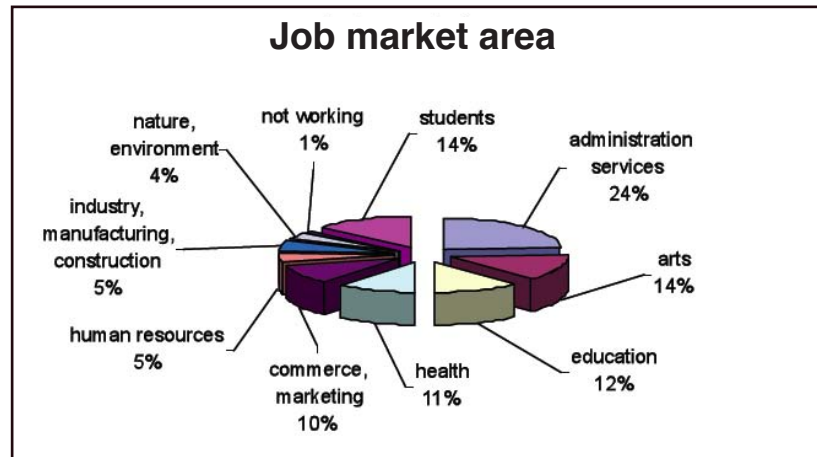


Engineering/exact sciences



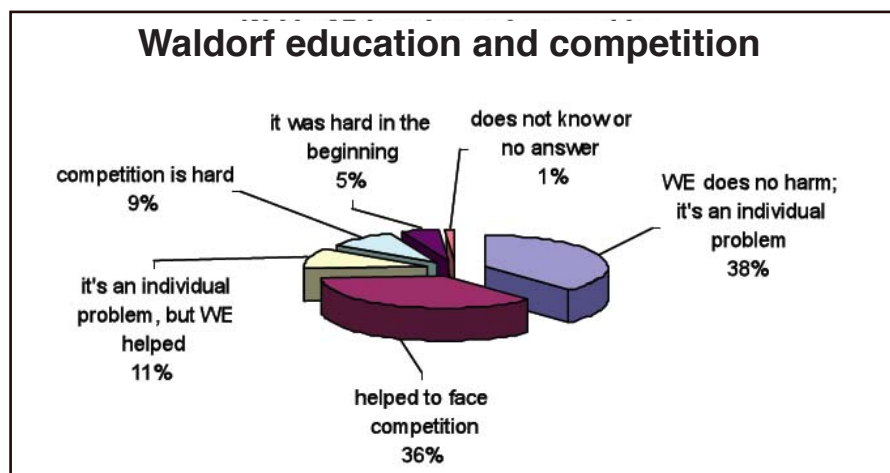
4.5 Myth number five: Waldorf education does not prepare its students for the job market.

There is a belief that Waldorf education educates people to work just in artistic areas. The next graph shows data about the jobs currently being held by the interviewed graduates.



4.6 Myth number six: Waldorf education does not prepare its pupils for a professional, competitive world.

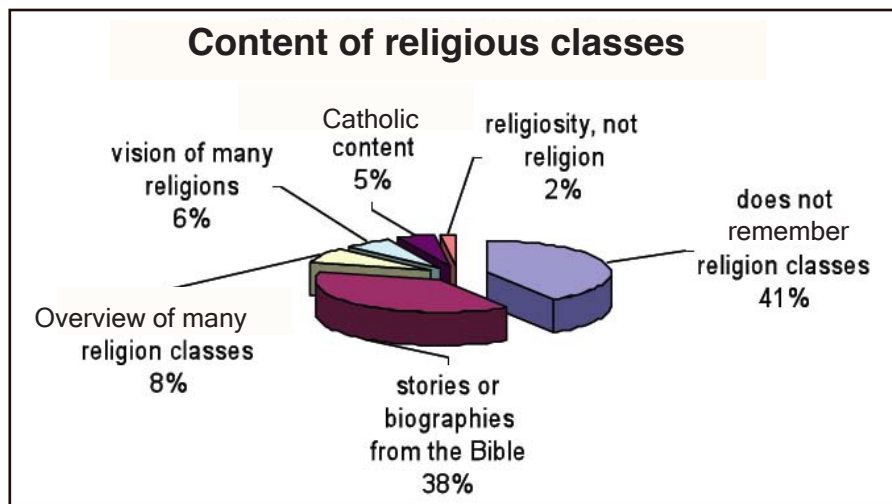
As Waldorf education gives a strong emphasis to social relations among students as well as being a humanistic form of education, there is a myth that its graduates leave school unprepared for dealing with competition in their jobs. To gain an insight into this question, graduates were asked if this had happened for them in their professional activities. The answers are plotted in the next graph.



The subtitles in this graph require some further explanation. 38% thought competitiveness in the job market and a humanistic background were completely different things. For them, to be prepared or not for competition was essentially a personal question, so Waldorf education did no harm. 36% thought Waldorf education helped because it prepared them to think and act in flexible ways and that these attributes were positively recognized when they were seeking a job. 11% said it is a personal question, but Waldorf education gave them elements that helped in some competitive situations, or gave them some ethical support. 9% thought they were harmed by Waldorf education because they did not feel prepared for any kind of competitiveness. 5% believed Waldorf education provided for a hard beginning as far as competition was concerned, but after some time they found their way, and 1% did not know how to answer this question.

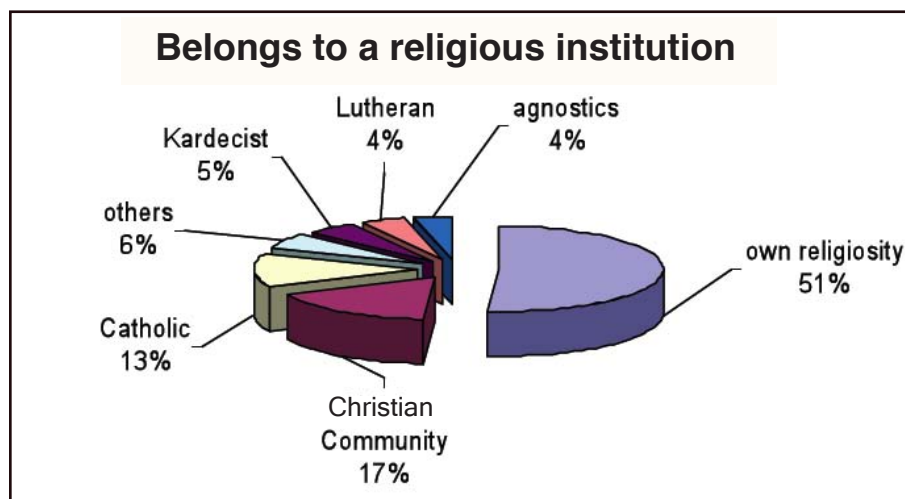
4.7 Myth number seven: It is a religious education.

Waldorf education is strongly based upon the spiritual worldview introduced by Rudolf Steiner, which he called anthroposophy. Some people regard it erroneously as a religion and claim that it contains a religious doctrine. Anthroposophy is explicitly not part of the school curriculum, and is in general never mentioned by teachers. Every religious school follows a specific doctrine or confession and has religious classes. Waldorf education recommends that students, mainly in their younger years, should have a religious education provided by their parents, church, synagogue, etc. In former years, the RSWS had representatives of various religious confessions come to give religion classes, but this ended due to the lack of interest on the part of the religious representatives. Applying Steiner's recommendation that young children should receive a religious education, some Waldorf schools offer so-called "free religion classes," in general given by the teachers themselves. On the other hand, bible stories and also stories from many religious traditions (like Hindu, Greek and Nordic myths, etc.) are part of the curriculum in the context of the history of mankind. The myth that Waldorf education is religious was investigated by asking what was the subject of the graduates' religion classes:



Some subtitles need further explanation. 38% remembered that classes covered stories and biographies from the Bible but without any religious doctrine; 8% said they had no specific religious classes because they entered the school during high school and there are no religion classes for that level; 6% reported that they received a view of several religions; 5% answered their religion classes had Catholic content because their parents were Catholic; 2% said religion classes did not bring any religious doctrine, and that Waldorf education is not a religious institution but it has a religiosity that can be noticed in several aspects, for example, in the verse that the students say at the beginning of every class day.

The next graph shows the distribution of graduates according to religious confessions.



For the Christian Community, see footnote 3; for Kardecism see footnote

4; “others” include Baptist, Jewish, Presbyterian, Buddhist, Cabalist, and adepts of Candomblé.⁵

4.8 Summary

Myth number one: Waldorf graduates are not able to pass admission examinations to Brazilian universities.

100% of the graduates who took admission exams were approved for admission.

Myth number two: Graduates are not admitted to first-rank colleges or universities.

68% were admitted into the best universities.

Myth number three: Graduates are not able to finish their university courses.

92% completed and graduated from their university courses.

Myth number four: Most Waldorf graduates become artists.

Only 12% chose artistic careers.

Myth number five: Waldorf education does not prepare for the job market.

99% are participating in the job market.

Myth number six: Waldorf education does not prepare for a professional competitive world.

84% did not experience any damage to their capacity to compete in the job market.

Myth number seven: It is a religious education.

100% did not experience any kind of religious indoctrination.

5. Conclusions

This study shows that the seven myths do not correspond to reality. The authors had the opportunity of presenting these results in lectures that they gave to parents and teachers and the general public in 12 Waldorf schools around Brazil. It was very gratifying to meet many people who were anxiously awaiting confirmation of their positive feelings with regard to Waldorf education. The audiences found these results meaningful because they shed light on some of their own questions regarding Waldorf schools.

Waldorf education has its own specificity. One of its distinctive

3. The Christian Community is a “movement of religious renewal.” Its founders had seen in Rudolf Steiner’s worldview “the decisive spiritual help for the age of natural science and, with this, a means of preserving Christianity in the twentieth century” (Hemleben, 1989: 142).

4. Kardecists are those adept of Alan Kardec’s worldview, which is based upon mediumship and is quite popular in Brazil.

5. Candomblé is an African religion which is a syncretism of Christianity with a kind of voodoo religion.

features is the essential participation of parents, teachers and students. This participation is very important because Waldorf education does not follow the usual educational standards, so students and parents develop a feeling of being “different.” Many people don’t like to be called “different,” so it is important that they become aware of the positive results provided by this education.

The number of differences between Waldorf education and all other educational methods is overwhelming. Nevertheless, the interviewed graduates found that the differences they saw during their education mainly fell into two categories: (1) the respect for the individual rhythm and maturity of each student, and (2) the assigning to the arts the importance they really have in education and developing personal abilities and sensitivity. Herewith we reproduce some quotes from the interviewed graduates about these two aspects.

On the respect for the individual rhythm and maturity of each student:

- “Waldorf’s aim is considering the necessities of each human being according to his age.”
- “There I could be myself. It is a question of trust.”
- “Human development for the whole of life, not just preparing for college”
- “Respect for each student’s learning process and individual assessment of each one’s progress”
- “The range of different kinds of experiences led to a deeper and wider development of the self.”
- “Respect for individuality”
- “Creative autonomy”

On the importance of the arts in the whole educational process:

- “It gives a global view of life.”
- “It gives flexibility to act in the world.”
- “It teaches many capacities.”
- The “people”
- “It makes the world bigger, shows other universes and expands your action.”
- “Art is a serious thing and we need to regard it as such.”

The authors did not have the intention of stating that Waldorf education is the salvation for the world; they simply wanted to bring, by means of this paper, some objective elements to help people learn about the results of some specific non-standard practices and get to know other points of view regarding education. Moreover, they know that school is an essential period of the human life, but that it certainly is not the only aspect in the formation of an individuality. There are others: family, friends, culture, religion, etc.

About Waldorf Education in Brazil

The first Waldorf School in Brazil was the Rudolf Steiner Waldorf School of São Paulo, founded in 1956 and originally called Escola Higienópolis (after the name of the neighborhood where the school was founded). In Brazil there are now about 70 schools that follow the principles of Waldorf education, including elementary/middle schools, with and without high schools, and independent kindergartens. (See the Waldorf education directory for Latin America, <http://www.sab.org.br/ped-wal/lawaldir.htm>, and the Waldorf Kindergarten directory for Brazil <http://www.sab.org.br/ped-wal/jardins.htm>). There are a number of Waldorf teacher training courses (the oldest and main one is situated at the RSWS), for those who want to become Waldorf teachers. The demand for Waldorf teachers is steadily growing every year.

About the authors

Wanda Ribeiro (wandar@uol.com.br) received her B.Sc. degree in Social Sciences from the University of São Paulo (USP) in 2001 and a degree in Social Education in 2003, also from USP. She has been a “Waldorf mother” since 2001 and took the Waldorf Teacher Training at the Rudolf Steiner School of São Paulo.

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STUDY OF WALDORF GRADUATES IN DENMARK

(Students who graduated from class 12
at Rudolf Steiner schools
in Gentofte, Herlev, Odense, and Århus, Denmark)

by

Troels Hansen

Introduction

Denmark has 5.5 million inhabitants. Its 15 Rudolf Steiner schools are covered by the legislation for free schools, which secures them financial support of approximately 75% of the average costs of a pupil in a state school. The classes 0 (preschool) and 1–10 are supported. Classes 11 and 12 are not covered by any legislation, are not officially recognized nor regulated, and are not financially supported. They are financed solely by parents' fees. Admittance to further and higher education (university level) for Steiner graduates is solely by exemption and on the basis of individual assessment.

There are no exams in the Rudolf Steiner schools. At the end of class 12, the students receive a written evaluation report for each subject together with the syllabus of the upper stage. As the Danish universities are at liberty to admit students by exemption, the RSS 12th class school reports have served as a basis for individual assessments, occasionally with the supplement of state exams in particular subjects at matura/baccalaureat level.

History

The first class 12 graduated in 1974 (from Århus), soon to be followed by Vidar Skolen, Gentofte, then Odense and Michael Skolen, Herlev. The present analysis covers the 'careers' of class 12 students who graduated from these four schools from 1982 to 2002, a period of 20 years. During these 20 years the respondents have met with changing educational, social, and employment conditions.

From 1995–96 to 2001 the conditions for class 12 students (and for the schools) were substantially improved due to the fact that during those years class 12 students received a state grant and a part of the education fees were reimbursed. In addition, this included extended coaching by the school, including the first year after leaving school. However, the legislation

that made this possible (the Open Youth Education Law) was abolished in 2002.

Today there are six schools that run 12th classes. The comparatively poor conditions with respect to finances and admittance to universities etc. have not improved—rather the reverse, due to the general tendencies in Danish education policy.

Explanations

The following terms and abbreviations are used with regard to the Danish educational system:

GENERAL YOUTH EDUCATION – gymnasium, upper secondary school: the (generally) three years of education that are concluded with Studentereksamen, matura, Abitur, A-levels, 'baccalaureat'

Its various branches are:

- Gymnasium – general education
- HX – commercial gymnasium
- TX – technological gymnasium
- F (full) - approximately equivalent to gymnasium, but addresses a different segment of users
- HF (single subjects) – a system of modules, that can in the end be an equivalent of a full HF as admission criteria for further studies

FUU – Open youth education: an individually designed youth education comprising a wide choice of activities, that existed from 1995–96 to 2001, thus involving a number of the respondents of the present analysis. It has since been abolished.

GSK – supplementary courses at gymnasium level to meet the specific demands of certain further and higher educations with respect to particular subjects

AVU – courses for students at all ages, qualifying for further studies

FURTHER AND HIGHER EDUCATIONS – studies of 'short,' 'medium' or 'long' duration, including university studies

FREE COLLEGES – colleges that offer courses of a mainly cultural kind, without providing formal Qualifications

- Some charts are expressed in words – therefore a few numberings have been skipped.
- Some charts are with comments – others speak for themselves in this brief summary.
- Not all questions have been answered by all respondents. This accounts for a very small number, though, and the filling-in and responding discipline has been absolutely satisfactory. For this reason the data material varies slightly from one question to the next. In some places the answer 'other' have been removed in order to condense the original tabulations of 214 pages into an acceptable volume for this extract – we refer to the complete report for more details.

DATA BASIS:

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Gross basis of analysis	1138	302	303	139	394
Number of responses	606	167	166	61	208
Percentage	53,3%	55,3%	54,8%	43,9%	52,8%

- A percentage of 53,3 responses is satisfactory, and this – taken together with the absolute number of responses (606) and the structure of the responses (an even distribution according to year of leaving school, age, and sex) makes the analysis very valid and representative.

1. Sex?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	606	167	166	61	208
Male	43%	38%	45%	57%	42%
Female	57%	62%	55%	43%	58%

2.Which school did you leave after class 12?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	602	167	166	61	208
Horizontal percentage		28%	28%	10%	34%

- Mikael Skolen with 61 responses represents 10% of the whole analysis and is the school with the narrowest basis (though when you compare the number of questionnaires with the number of returned responses, the material is still fairly satisfactory).

3. In which year did you leave class 12?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	599	164	165	61	205
1982	3%	4%	1%	0%	4%
1983	4%	4%	2%	0%	5%
1984	4%	4%	1%	0%	7%
1985	5%	5%	4%	3%	7%
1986	4%	3%	3%	2%	7%
1987	3%	4%	3%	0%	2%
1988	4%	3%	5%	0%	3%
1989	5%	3%	7%	2%	6%
1990	6%	6%	8%	10%	2%
1991	3%	5%	2%	0%	3%
1992	7%	7%	7%	7%	8%
1993	6%	3%	8%	5%	7%
1994	7%	9%	3%	16%	6%
1995	5%	3%	7%	7%	4%
1996	7%	6%	8%	13%	5%
1997	6%	9%	7%	8%	2%
1998	5%	3%	4%	10%	5%
1999	4%	5%	5%	2%	3%
2000	4%	5%	5%	5%	2%
2001	4%	5%	4%	2%	5%
2002	5%	4%	5%	7%	4%
Don't know/ don't want to answer	0%	0%	0%	3%	0%

- Even distribution on all years – valid and representative analysis with respect to the entirety of students having left the schools (no bias due to 'new' or 'old' graduates).
- As many as 72% of all respondents have attended the school for 12 or 13 years (with or without pre-school class). 15% have attended the school for 9-11 years.
- A satisfactory basis for evaluating the schools.

5. Your age at the moment of answering the questionnaire?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	604	166	166	61	207
24 years or less	26%	28%	29%	33%	21%
25-29 years	32%	28%	35%	48%	29%
30-34 years	22%	24%	25%	13%	20%
35-39 years	19%	18%	11%	5%	30%
40 years or more	1%	2%	1%	2%	0%
Don't want to answer	0%	0%	0%	0%	0%

BASIC QUESTION – PRESENT OCCUPATION!

7. What is your occupation right now, at the beginning of 2003?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	605	166	166	61	208
Employment	47%	45%	45%	59%	48%
Education	37%	34%	44%	30%	36%
Other	16%	21%	11%	11%	17%

Other occupation – percentages of the above 16%:

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	94	34	18	7	35
Maternity or other leave	32%	26%	39%	14%	37%
No defined occupation	5%	12%	0%	14%	0%
Unemployed - involuntarily	22%	15%	22%	29%	29%
Sabbatical between Steiner school and studies	1%	3%	0%	0%	0%
Other	39%	44%	39%	43%	34%

ALL RESPONDENTS – CURRENTLY IN EMPLOYMENT OR EDUCATION

8. Which education have you finished most recently?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	597	166	165	59	203
Class12 at a Rudolf Steiner school	13%	11%	14%	20%	11%
General youth education	38%	37%	41%	37%	34%
Vocational education	10%	11%	12%	10%	8%
Further and higher education	39%	40%	33%	32%	46%

- Please note that this is just a picture of the situation at the moment of answering. Those who are in the middle of further and higher education will appear as belonging to a 'lower' category.

IF GENERAL YOUTH EDUCATION

Which youth education have you finished? (see explanations at the beginning of the analysis)

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	235	63	71	22	77
Full HF or 3 years gymnasium (general, HTX, HHX)	11%	10%	14%	9%	10%
HF (single subjects), GSK (supplementary courses at gymnasium level), AVU, admission courses or the like.	31%	32%	27%	32%	35%
FUU (free youth education)	46%	41%	48%	50%	45%
Other	12%	17%	11%	9%	9%

IF VOCATIONAL EDUCATION

Which vocational education have you finished?

- Many different, 'quite normal' and broadly representative vocations from electrician to storehouse assistant and hothouse gardener, etc. etc.

IF FURTHER AND HIGHER EDUCATION

Which particular further and higher education have you finished? (name of education, e.g. veterinary doctor, laboratory technician, etc.)

- Again a variety of educations – see categorization below.

Duration of your further and higher education?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	230	65	54	19	91
Short (1-2 years)	13%	9%	11%	11%	18%
Medium (3-4 years)	50%	58%	37%	47%	53%
Long (5 years or more)	37%	32%	52%	42%	30%

In which field did you do your further and higher education?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	229	67	52	18	91
Humanistic and theological	9%	10%	6%	17%	8%
Pedagogical	21%	24%	17%	22%	20%
Artistic	19%	21%	15%	11%	22%
Natural sciences	11%	13%	12%	6%	9%
Social sciences and economics	5%	3%	10%	6%	4%
Communication and commercial languages	4%	1%	10%	6%	2%
Technology	10%	10%	6%	17%	11%
Transportation	0%	0%	0%	0%	0%
Food technology	0%	0%	2%	0%	0%
Agriculture and fishing	0%	0%	2%	0%	0%
Health	13%	12%	12%	6%	15%
Police and army	0%	0%	0%	6%	0%
Don't know	0%	0%	0%	0%	0%
Other	7%	4%	10%	6%	9%

11. Did you carry through your further and higher education within the prescribed time (norm)?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	529	150	140	49	187
Norm	78%	79%	79%	82%	77%
Less than norm	3%	3%	2%	2%	3%
Longer than norm	19%	17%	19%	16%	20%

- The high number of studies carried through within the norm or in a shorter time is impressive.

If longer than norm – how many months more?

- On average 12-18 months

IF LONGER THAN NORM:

12. What was the reason for the delay?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	97	25	26	8	37
The education was too demanding	13%	20%	12%	0%	14%
Did projects relevant to the studies during the education	21%	24%	31%	0%	14%
Maternity	25%	32%	12%	13%	32%
Work, primarily in order to earn money	22%	12%	23%	13%	27%
Work, primarily relevant to studies	13%	16%	12%	13%	14%
Illness	4%	0%	4%	0%	8%
Illness in the family	2%	0%	4%	0%	3%
Travels	19%	16%	15%	25%	22%
Sports or other leisure occupations, demanding time	3%	0%	8%	0%	3%
Political work/career	2%	4%	4%	0%	0%
Voluntary work/career in clubs, sports, etc.	3%	4%	0%	25%	0%
Other	45%	52%	50%	50%	38%

- Various reasons – a great number of 'acceptable' explanations like maternity, relevant projects, or work, illness, or the wish to deal more thoroughly with research projects, final thesis, and the studies as such (some point out that the prescribed time is unrealistic)
- Some double coverage – 1,74 answer per respondent

IF LONGER THAN NORM:

13. Did you take a period of leave during your education, or did you 'just' carry it through in a longer time than prescribed, i.e. prolonged without actual leave?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	93	23	24	8	37
Leave during studies	44%	57%	29%	63%	43%
No leave during studies	56%	43%	71%	38%	57%

- Most of the leaves were maternity leaves
- Those who were not on leave, say that it was not necessary

**14. Have you finished other vocational or further and higher education apart from the above mentioned?
Don't include class 12 or preparatory courses (HF, GSK, etc.)**

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	549	155	147	53	190
No	83%	81%	82%	94%	81%
Yes	17%	19%	18%	6%	19%

- As many as 83% have not finished any other education – no chopping and changing between courses.
- Those who have more than one education answer primarily that it is for example a supplement to their original studies, or that they found a new field of studies that was more interesting to them.

17. Have you, in the course of your education begun and subsequently interrupted a vocational or further and higher education (begun, but not completed)? Don't include class 12 or preparatory courses (HF, GSK, etc.)

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	524	142	143	52	183
No	79%	79%	81%	77%	79%
Yes	21%	21%	19%	23%	21%

- As many as 79% have not interrupted an education – they begin, and they carry through!

19. Why did you interrupt your education?

- Primarily motivated by wish (not failing to meet the demands of the studies, fear of exams, etc):
 - Got interested in new field (33%),
 - Lost interest (31%)
 - Other (31%): Very different answers – no unambiguous line

CURRENTLY IN EDUCATION:

20. What kind of education are you taking?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	268	69	79	26	92
General youth education	29%	29%	30%	27%	28%
Vocational education	9%	6%	9%	4%	14%
Further and higher education	62%	65%	61%	69%	58%

- 62% speak for themselves!

IF GENERAL YOUTH EDUCATION:
Which general youth education?

- FUU (51%) - full HF (17%) and HF single subjects, GSK etc. (17%)

20a. Do you plan to take a vocational or further and higher education after your youth education?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	71	20	21	6	23
No	6%	5%	5%	0%	9%
Yes	94%	95%	95%	100%	91%

- They want to continue studies – primarily in further and higher education

IF FURTHER AND HIGHER EDUCATION:
Which further and higher education (name the education, e.g. veterinary doctor, laboratory technician, etc.)?

- Very different educations in all kinds of fields, see more below
-

Duration of your current further and higher education?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	155	42	47	15	50
Short (1-2 years)	9%	5%	6%	13%	14%
Medium (3-4 years)	35%	31%	36%	40%	36%
Long (5 years or more)	56%	64%	57%	47%	50%

In which field is your current further and higher education?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	162	44	48	18	51
Humanistic and theological	23%	25%	31%	11%	20%
Pedagogical	15%	14%	13%	22%	18%
Artistic	18%	14%	19%	33%	14%
Natural sciences	7%	9%	6%	0%	8%
Social sciences and economics	13%	11%	15%	0%	18%
Communication and commercial languages	4%	2%	6%	6%	4%
Technology	6%	9%	4%	6%	6%
Transportation	0%	0%	0%	0%	0%
Food technology	1%	0%	0%	0%	2%
Agriculture and fishing	1%	2%	0%	0%	0%
Health	14%	16%	13%	17%	12%
Police and army	1%	2%	0%	6%	0%
Don't know	0%	0%	0%	0%	0%
Other	10%	5%	15%	11%	12%

21. To what degree do you feel that what you learned at your Steiner school has equipped you with what you needed to get the education you wanted?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	575	159	159	56	197
To a very large degree	23%	19%	26%	32%	20%
To a large degree	37%	40%	33%	41%	37%
To some degree	25%	25%	23%	20%	28%
To a small degree	8%	7%	9%	4%	10%
Not at all	2%	3%	4%	0%	2%
Don't know	5%	6%	5%	4%	3%

- 60% feel to a large or very large degree that what they learnt at Steiner school has equipped them with what they needed to get the education they wanted. Only 10% say 'to a small degree' or 'not at all'.

22. Which qualities and competences from your Steiner school education have been of use to you in your further education, and which have not been of use?

Things from your school education that have been of use to you?

- Many detailed and many-sided answers!
- A homogenous picture – three fields:
 - o Creativity – musicality
 - o A way of viewing and understanding human beings – empathy – social competences
 - o Independence – self-assurance – authenticity

22b Things from your school education that have not been of use to you?

- Far fewer answers than above
- Primarily eurythmy and 'the academic level' of the teaching

22c What have you missed in order to be better equipped for further education?

- Experience in passing exams
- Assessment in the form of marks
- Better qualifications in the classical fields: maths, physics, and biology
- Social studies

23. To what degree do you have/get an education that satisfies you?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	569	156	157	58	194
To a very large degree	41%	43%	39%	33%	42%
To a large degree	41%	38%	46%	52%	37%
To some degree	11%	10%	9%	12%	14%
To a small degree	1%	1%	1%	0%	1%
Not at all	1%	1%	1%	0%	1%
Don't know	5%	8%	4%	3%	5%

- 82% (!!!!!) get/have to a large or very large degree an education that satisfies them. Only 2% answer 'to a small degree' or 'not at all'.

ALL RESPONDENTS

25. Are you employed at the moment?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	602	165	164	61	208
No	32%	35%	34%	18%	31%
Yes	68%	65%	66%	82%	69%

IF NO IN COL. 25, I.E. YOU ARE NOT EMPLOYED NOW,

26. Have you been employed earlier?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	179	55	49	10	63
No	15%	18%	14%	10%	13%
Yes	85%	82%	86%	90%	87%

If yes, why are you not employed now?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	148	42	42	9	54
Am unemployed, was given notice	9%	12%	2%	0%	13%
Have chosen to be unemployed	16%	17%	24%	0%	11%
Was employed, but am now in education	49%	48%	50%	78%	44%
Pensioner	4%	5%	5%	0%	4%
Other	22%	19%	19%	22%	28%

- Many (68%) are employed now
- Most of those who are not employed, have had a job
- If people are not employed, it is primarily because of education
- 4% unemployment – see also below

28. In what field of professions or trade is your work?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	451	120	121	51	
Industry and production	6%	13%	2%	4%	
Energy and water supply, renovation	1%	0%	1%	0%	
Building and planning	8%	8%	9%	12%	
Retail trade	5%	5%	7%	6%	
Hotels, restaurants, other trade	8%	7%	12%	8%	
Transportation, post, and telecommunication	5%	7%	2%	10%	
Agriculture/forestry/fishing	2%	1%	2%	0%	
Banking, finance, and insurance	1%	0%	2%	0%	
Private business service, liberal professions	9%	9%	11%	8%	
Organisations, art, and culture	6%	4%	7%	6%	
Health and welfare institutions	20%	18%	15%	18%	
Teaching	15%	13%	15%	14%	
Police and army	1%	0%	0%	2%	
Other	28%	28%	31%	29%	

- Primary fields of work: teaching, health, and welfare – apart from that widely spread.
- We compare with the structure in comparable youth cohorts.
-

30. What is the category of your job?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	438	122	114	47	153
Independent	12%	12%	13%	13%	10%
Helping in husband's/wife's business	0%	0%	0%	0%	0%
Salaried employee	29%	32%	27%	32%	26%
Salaried employee (leader/manager)	8%	8%	9%	2%	8%
Skilled worker	16%	16%	13%	13%	18%
Unskilled worker	26%	22%	31%	36%	22%
Early retirement	0%	1%	0%	0%	1%
Unemployed	4%	7%	2%	2%	3%
Other	11%	7%	9%	11%	17%

31. To what degree do you feel that what you learned at Steiner school has equipped you with what you need for your present job?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	460	120	127	50	160
To a very large degree	19%	17%	19%	30%	17%
To a large degree	32%	33%	30%	38%	32%
To some degree	28%	24%	31%	24%	30%
To a small degree	9%	11%	8%	4%	9%
Not at all	7%	10%	8%	4%	4%
Don't know	5%	4%	5%	0%	6%

- They feel to a large degree equipped for their job by their Steiner education – presumably more so than an entire youth cohort (as far as we know this has not been investigated).

32 In what way? Which qualities and competences from your Steiner education have been of use to you in your work, and which have not been of use?

32a Things from your school education that have been of use to you?

- Again 'no bad' experiences
 - Creativity – imagination, ...
 - Autonomy – responsibility
 - Understanding of human beings – empathy

32b Things from your school education that have not been of use to you?

Again – not surprisingly – eurythmy

33. Have you, after leaving class 12, needed to attend any preparatory courses (GSK, IIF etc.) to gain admission to the education or the job you want/wanted?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	591	164	161	57	205
No	40%	40%	40%	58%	37%
Yes	60%	60%	60%	42%	63%

- 40% did not need to attend further preparatory courses.

IF YES:

Which supplementary courses did/do you attend?

- Mainly HF single subjects (59%) and a full HF (18%)

IF YES: YOU ARE ATTENDING OR HAVE ATTENDED OTHER PREPARATORY COURSES APART FROM CLASS 12:
34. Why did you consider it necessary for you to attend these further courses?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	345	97	95	24	125
To achieve the necessary marks	55%	54%	58%	38%	58%
Because classes 11 and 12 were not recognized as a sufficient academic basis	48%	42%	46%	63%	50%
Because my school report was not recognized as sufficient documentation	48%	41%	53%	38%	52%
I did not feel that my qualifications were up to the demands of my education or my job	24%	28%	29%	17%	20%
I was uncertain as to what education or occupation I wanted	20%	18%	29%	21%	14%
Other	26%	33%	23%	33%	22%

- They attend supplementary courses to get marks or because their school reports are not recognized.
- Only 24 % say that they were not academically equipped to join the education they wished (which was to a large degree a further and higher education of medium or long duration)
- They do not find, though, that it is a matter of double education:

35. To what degree do you think that classes 11 and 12 and the supplementary courses you attended afterwards, represent a 'double', overlapping education?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	332	95	89	24	120
To a very large degree	8%	4%	11%	13%	8%
To a large degree	20%	15%	17%	21%	25%
To some degree	35%	34%	39%	29%	32%
To a small degree	20%	28%	17%	17%	17%
To a very small degree	15%	16%	13%	13%	16%
Don't know	3%	3%	2%	8%	3%

37. How long did it take from you left class 12 till you began the education you have most recently concluded?

IF YOU HAVE NOT CONCLUDED ANY EDUCATION BEYOND CLASS 12, DON'T ANSWER THIS QUESTION.

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	488	135	137	43	170
3 months or less	16%	17%	14%	30%	14%
4 – 6 months	2%	2%	3%	0%	1%
7 - 12 months	6%	3%	9%	12%	4%
1 year and more, but less than 2 years	13%	17%	12%	9%	10%
2 years and more, but less than 3 years	15%	14%	20%	14%	13%
3 years and more, but less than 4 years	14%	13%	13%	19%	14%
4 years and more, but less than 5 years	11%	10%	13%	5%	14%
5 years and more	23%	24%	15%	12%	30%

- It takes comparatively long to start the actual education – but then it is a valid choice (see above – few interruptions of education), and the studies are to a large degree carried through within the prescribed time
- A comparison with nationwide figures is yet to be carried through
- The respondents spend time working, traveling, preparing for studies, attending free colleges, etc. (in the charts report you can see what they have been occupied with, for half a year at a time)

USE OF SCHOOL REPORTS

39. In which situations have you used your report?

YOU MAY MARK MORE THAN ONE ANSWER:

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	596	165	162	60	205
Application for entering an education	62%	65%	57%	60%	64%
Application for job	16%	16%	14%	18%	17%
Other situations	7%	7%	7%	10%	5%
Report not used	31%	27%	34%	28%	31%

- As few as 31% have not used their report – 62% (!) have used it , applying for admission to an education

40. In what way did you use your report in connection with education or work?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	402	120	102	40	138
Was admitted to education and/or got job on account of the report.	12%	12%	13%	17%	12%
Used report actively, combined with supplementary marks, free college studies, etc..	53%	53%	49%	47%	57%
Report only shown (used to a very small degree)	30%	31%	33%	30%	27%
Other	4%	4%	5%	5%	4%

- 12% were admitted on account of the report only
- 53% used it actively
- As few as 30% 'only' showed it

41. How was the report received, and what was the reaction to it as a documentation of your qualifications and your personal strengths and weaknesses?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	399	119	103	40	135
Very positive	8%	6%	8%	13%	7%
Positive	26%	32%	19%	25%	24%
Neither nor	29%	27%	35%	25%	29%
Negative	4%	4%	4%	5%	4%
Very negative	2%	0%	4%	5%	2%
Don't know	31%	31%	30%	28%	33%

- The reception was neutral (60% - 'neither nor' and 'don't know') or moderately positive
- Perhaps the form can be made more stringent and/or changed in style, in order to make it more weighty and more widely recognized?
- Read more in the charts about reception
- The reason for not using the report is that it is unnecessary - qualifications are documented in other ways
- The respondents achieve their qualifications through courses with marks (27%) and admission courses (32%) - but many other paths give qualifications: work (30%), stays abroad (23%), and attending free colleges (19%). This throws a particular light on the comparatively long time, spent between leaving class 12 and beginning the actual education - many things qualify (but in a wider context)

44. Would it have been easier for you to gain admittance to an education or to get a job if you had had a report from the Steiner school with marks?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	591	162	162	58	205
Yes, much easier	34%	33%	33%	19%	39%
Yes, a little easier	21%	22%	22%	29%	18%
No, not easier	27%	23%	28%	31%	27%
Don't know	18%	22%	17%	21%	17%

- Marks is an issue – they would have smoothed the path

GENERAL SATISFACTION:

46. How satisfied or dissatisfied are you ON THE WHOLE with having attended Steiner school?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	603	166	165	61	207
Highly satisfied	54%	49%	59%	66%	52%
Satisfied	39%	45%	35%	33%	40%
Neither nor	4%	4%	3%	2%	6%
Dissatisfied	1%	1%	2%	0%	1%
Deeply dissatisfied	1%	1%	1%	0%	1%
Don't know	0%	1%	1%	0%	0%

- 54% are highly satisfied, and 39% are satisfied, altogether 93%. Only 2% are dissatisfied!
 - Many, many pages of reasons for and examples of what has caused most satisfaction and dissatisfaction:
- Satisfaction:
- Creativity
 - The teaching methods
 - The social coherence
 - Manysidedness
 - The view of human beings – broadness of scope

Dissatisfaction:

- Not enough discipline and following up on offences
- Not enough focus on proficiency
- Eurythmy
- When views of life get too narrow (Not enough openness, reservedness, dogmatism, attitude towards society, wrong protection)
- The schools should adjust faster to the demands of the time (IT, general developments in society) without sacrificing the Steiner concept, their identity and values
- They should dare to be modern with a strong identity of their own

50. Looking back, do you think you would have been in a better position IF you had left Steiner school after class 9 or 10 and had perhaps attended a gymnasium, vocational, or other youth education?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	587	160	159	59	205
Much better	4%	4%	5%	3%	4%
Better	14%	13%	11%	7%	20%
The same	14%	16%	13%	12%	15%
Worse	32%	34%	35%	34%	27%
Much worse	15%	11%	19%	27%	13%
Don't know	20%	22%	18%	17%	21%

- Very few think that they would have been in a better position IF they had left Steiner school after class 9 or 10
- The main part think they would have been in a worse position

ALL:

54. On the whole a Steiner school sets its priorities in a way, different from other schools. What is your opinion of the various fields, listed below – is it positive or negative?

All schools added together – total:

	Total	Very positive	Positive	Neither nor	Negative	Very Negative	Don't know
No marks	100%	29%	26%	15%	19%	8%	2%
No exams	100%	25%	25%	16%	24%	8%	2%
Undivided classes	100%	35%	34%	15%	8%	1%	7%
Importance of crafts	100%	63%	29%	5%	2%	0%	0%
Importance of arts	100%	68%	25%	4%	2%	1%	0%
Movement during lessons (e.g. eurythmy, stamping the tables, etc.)	100%	31%	34%	18%	10%	5%	2%
The class 12 final project	100%	66%	26%	6%	1%	1%	1%
Subjects taught in periods/main lessons	100%	65%	27%	5%	2%	1%	0%
One class teacher during basic school	100%	63%	26%	5%	3%	1%	2%

- Generally positive attitude towards:
 - Crafts
 - Arts
 - Class 12 final project (stressed significantly in the open responses)
 - Subjects taught in periods
 - One class teacher during basic school
- Neutral attitude towards:
 - Movement during lessons
 - Undivided classes
- Comparatively negative attitude towards (consistent with what respondents have missed/what could have put them in a better position):
 - No marks
 - No exams
- The figures from the various schools can be seen in the charts report

56. Would an increased use of actual textbooks in classes 11 and 12 be better or less good than period folders/notebooks? Textbooks would be...:

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	583	161	157	60	201
Much better	21%	24%	15%	8%	27%
Better	35%	37%	31%	38%	36%
Neither nor	19%	20%	22%	17%	15%
Less good	12%	7%	17%	18%	10%
Far less good	5%	5%	8%	8%	2%
Don't know	8%	7%	8%	10%	10%

- 56% find that actual textbooks would be better in classes 11 and 12 (would introduce 'normal' teaching and be a better preparation for studies – without renouncing all the other good things!)

57.If you look at your subsequent education and work as well as at your 'life as a whole', how do you feel equipped by your Steiner education in the following fields?

All schools added together – total:

	Total	Very well	Well	Neither nor	Badly	Very badly	Don't know
History and religion	100%	20%	47%	20%	10%	3%	1%
Present day Danish and international affairs	100%	7%	29%	29%	24%	10%	1%
Natural sciences, such as physics, chemistry, biology, and geography	100%	5%	27%	30%	25%	12%	2%
Foreign languages	100%	22%	42%	19%	12%	5%	1%
Maths	100%	11%	32%	24%	22%	10%	2%
Danish literature and language	100%	24%	44%	21%	8%	3%	1%
Artistic fields, music, painting, etc..	100%	64%	30%	6%	1%	0%	0%
Practical fields, such as woodwork, needlework, etc.	100%	63%	31%	5%	1%	0%	0%

Very well equipped in:

- Artistic fields
- Practical crafts and skills

Well equipped in:

- History and religion
- Foreign languages
- Danish literature and language

Neutral/badly equipped in

- Mathematics
- Natural sciences, such as physics, chemistry, biology, and geography
- Present day Danish and international affairs

GENERALLY EQUIPPED FROM YOUR STEINER EDUCATION:

All schools added together – total:

	Total	Very well	Well	Neither nor	Badly	Very badly	Don't know
Reading skills	100%	46%	36%	9%	7%	2%	1%
Mathematic skills	100%	16%	38%	22%	18%	6%	1%
Language skills	100%	26%	41%	19%	10%	2%	1%
Praktical skills	100%	58%	33%	8%	1%	0%	0%
Collaborating competence	100%	56%	32%	9%	1%	0%	1%
Social competence	100%	60%	31%	8%	1%	0%	1%
Empathy	100%	66%	27%	5%	1%	1%	1%
Capacity for innovative thinking	100%	50%	39%	8%	1%	1%	1%
Critical sense	100%	43%	38%	15%	3%	1%	1%
Tolerance of problems and conflicts	100%	35%	40%	17%	5%	1%	3%

- The main tendency as to where one feels well equipped - which is the case in quite a lot of places – in bold letters

58. How active are you in the following fields in your spare time?

All schools added together – total:

	Total	Very active	Fairly active	Average activity	Practically not active	Not active	Don't know
Sports in club	100%	9%	11%	13%	12%	55%	0%
Sports, not in club	100%	10%	20%	30%	17%	23%	0%
Play music	100%	12%	11%	15%	22%	40%	0%
Listen to music	100%	38%	34%	23%	4%	1%	0%
Reading Leisure	100%	32%	29%	30%	8%	1%	0%
Watch TV	100%	8%	23%	49%	14%	6%	0%
Computer - surf/play	100%	11%	19%	36%	20%	14%	0%
Club activity	100%	11%	11%	11%	13%	54%	0%
Board activity	100%	10%	11%	11%	9%	57%	1%
Spend time with friends	100%	32%	37%	28%	2%	1%	0%
Spend time with family	100%	38%	35%	24%	4%	0%	0%

The Steiner schools plan to carry through eventually with a more detailed qualitative biography project in order to get a deeper and more differentiated insight into the biographies of former pupils and how their competencies from their education serve them. If this biography project is launched (and if its volume is acceptable), would you be prepared to take part in it?

	Total	Rudolf Steiner Skolen i Odense	Vidar Skolen i Gentofte	Mikael Skolen i Herlev	Rudolf Steiner Skolen i Århus
Basis	458	123	128	47	156
Yes, certainly Ja, helt sikkert	43%	33%	48%	57%	44%
Yes, perhaps	45%	51%	43%	38%	42%
No, probably not	7%	11%	4%	2%	8%
No, certainly not	3%	4%	2%	2%	3%
Don't know Ved ikke	2%	2%	3%	0%	3%

- 88% say that they would certainly or perhaps take part in a more detailed biography project
- We have adresses etc.

INTERNAL CHALLENGES/DEVELOPMENT PROJECTS FOR RUDOLF STEINER SCHOOLS IN DENMARK

As a followup to the analysis “Where did they go?” a number of issues arise, which the schools would do well to take up. These comments list these challenges/development projects and were written with a view to encourage and support internal discussions. Obviously the items listed are ‘problem’ orientated and do not deal with all the positive aspects that were also part of the outcome of the analysis.

The subjects have to do with the upper level only, in some cases specifically with classes 11 and 12. The order of the subjects is arbitrary and does not signify any kind of prioritization.

POTENTIAL FIELDS OF INTERNAL DEVELOPMENT IN THE LIGHT OF THE ANALYSIS

1. Marks

The respondents would have wished to have marks or some other kind of more concrete assessment. Many have solely for this reason had to attend one or more courses at GSK, HF, etc. This question hangs together with the following remarks on school reports

2. School reports

A surprising number have actually used their reports, but many would have liked to have had a more ‘intelligible’ and precise report. Not that they want the descriptive texts replaced by figures or other kinds of ranking, but an additional ‘executive summary’ and some kind of objective indicators (perhaps in colors?) with regard to their competencies would be a great help. Which place would be better suited for such a broadly designed competence-indicator model than the Steiner school?

3. Textbooks

A significant majority want the tools for study in classes 11 and 12 supplemented with actual textbooks, among other things, as a regular practice of ‘studying’ (see below).

4. Preparation for studies

Many feel that after classes 11 and 12 they were not sufficiently trained in the discipline of ‘studying.’ They would like the later period of upper school to be more orientated towards studies, by means of textbooks, training for exams/simulating exam situations, and other activities, such as exam labs, study labs, etc.

5. Social studies and biology

Many seem to have experienced a vacuum in these two fields.

6. Eurythmy

Movement as a basis for the teaching and learning in school is an intrinsic part of the school’s concept. The pupils neither understand nor experience or realize this. They find little use for eurythmy in particular and show little appreciation for its connection with learning, competencies, and general positive effects. The schools ought to re-think, re-tell, and revitalize the ‘stories’ with which they describe among themselves the reasons for teaching eurythmy, thus putting it in the context of other subjects, of learning in general, of the ability to express oneself in different bodily dimensions, etc.

POTENTIAL FOR DEVELOPMENT – MY COMMENTS

Apart from the subjects that are more or less specifically based on the results of the analysis, I have included a few themes which are not directly specified in the analysis... but then again...

The subjects below are partly a further interpretation of the analysis and partly a comment based on my own opinions and observations (exclusively from the school in Odense, where I have been a parent for 12 years [plus two years in kindergarten]) as well as on a long conversation with professor of organizational development, Claus Otto Scharmer (MIT).

7. Genuine involvement

A much stronger and more open involvement of all parents, former pupils, local politicians, etc. Exploring new and different ways of being together, for example, the ownership project from Witten (Claus Otto Scharmer).

8. Clarifying the school's identity and making it visible

Design, logo, branding, aesthetics, reputation...strength or weakness? From traditional 'closeness' to progressive 'openness.'

9. Life around the school

A new strategy for lectures, activities, initiatives – everyday life and festivities – where the schools to a much larger degree take a position in the face of challenges in our society, and into which the thoughts that are behind the school/anthroposophy enter actively.

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