



Advantages and Disadvantages of Brain Research for Education

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Brain research has brought us some useful insights and a deeper understanding of teaching and learning. Some research results, however, only confirm what we already know or believe we know about education. These results are important because they provide a necessary background for educational policy and because they deepen our knowledge. Other research opens new and sometimes surprising insights into the organic basis of human development.

One of the most important insights is discovery of the environment-dependent plasticity of the human brain. Brain structure may change continually, particularly during childhood, but also in adults, dependent on experience and the spiritual activity of the individual.¹ To some degree, human beings continue to develop new brain structures as they stimulate some areas and neglect others, depending on their activities and interests. This development relates not only to the renewal of synaptic connections between brain cells and those areas that are particularly stimulated (e.g., through skilled occupation), but, as new research suggests, to experiences that encourage a regeneration of cells, at least in some areas of the brain (this is called neurogenesis, and occurs, for example, when olfactory neurons react to a new scent).

We are thus lifelong sculptors of our brains, and we are also active co-designers of important organic conditions for our more or less complex emotional and spiritual abilities. Brain plasticity advocates, by inference, a versatile but ordered—and not too demanding—education for children; a balanced education of head, heart, and limbs. Only through such “whole” experiences can human beings, through their organic brain rudiments, react to given challenges in a flexible, socially correct, and creative way.² Ultimately,

physical activity and emotions, which, according to brain research, are decisive for learning experiences, allow learning experiences to manifest themselves organically in the brain.

In this respect, research contradicts the intellectual or cognitive interpretation given to it by demands for “brain exercise,” “Baby Einstein,” “PISA-Power training” or similarly uninspiring “neuro-didactic recommendations.” Instead, brain research shows clearly that instructional learning does not lead, in the long run, to “storage” of what has been learned. Rather, sensual experience, happiness and disappointment, and wonder and discomfort are constituent elements of learning and brain development.³ The ordered multi-

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licity of experience, and association-rich artistic and creative activities, produce an association-rich brain structure, one 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 “pathways” 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 yielded interesting insights into adolescent life and its culture of screen media. 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, it is accompanied by an impoverishment of literary competence: 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 a large number of text 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—are obvious.⁴ Language, especially, with its implicit hierarchies and syntactic figures, but also mime, gesture, movement, and social interaction; practical experiences in school; and emotional exchange with other persons are examples of important elements for 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 possibilities for adolescent development.

From a pedagogical point of view, insight into the individual brain structure of each child is also important—even with identical twins. The reason behind this is the experience dependence of individual human brain formation. No brain completely resembles another because, for one thing, there is no absolutely identical level of human experience.⁵ Different levels of development in different children at any age can be explained, in part, by the effects on different brain structures of specific experiences. These differences ask for a teacher's marked alertness to children at different stages of development. These differences also argue against reaching too hasty a conclusion concerning what a child should be able to do at a certain age. Differences in development make for an important argument against any blanket or generalized statements about the learning process. For this reason, pupils should not be measured with the same stick or subjected to a standardized program without also including, minimally, individual attention and encouragement.

The neuro-theoretical debate about free will and mechanical metaphors of brain research appear, in this context, to be symptoms of a much deeper cultural trend, one which numerous brain researchers and their pedagogical servants loyally applaud—instead of finding and developing other paradigms of brain research.

In Germany—and other nations—this conclusion relates to increasing early enrollment in schools. The undimmed euphoria for an alleged early advancement is accompanied by research that shows that a significant number of children enrolled later (at the age of about 6 years) shows better school results than those enrolled earlier (at the age of about 5 years) or, at least, does not display any general advantage of early enrollment.⁶ An international survey by the British Association for Early Childhood Education concludes that enrollment in such programs prior to the age of 6 years provides no advantage in language and mathematical skills.⁷

Recent brain physiology studies by Philip Shaw and colleagues show that children who develop relatively more slowly during their preschool and primary school years later often achieve a thicker layer of the brain neo-cortex and greater intellectual achievements than children whose development was subjected to a relatively intense “early promotion.”⁸ A depletion of this region of the brain, according to researchers, has consequences not only for the three brain areas associated with the “three main competencies” (reading, writing, arithmetic), but also for the capacity to digest and integrate sense impressions. David Shore and colleagues’ results are clear: Children can adequately integrate different complex sense impressions up to the age of 10 only if they are allowed sufficient space for development.⁹ Summing up empirical results on 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 or pressure.

Many research results are highly relevant to education, although they tend to portray early and suggestive indications as sound conclusions. In this category belongs, for example, the discovery that an essential part of effective long-term learning takes place during sleep—providing

there is a healthy sleep pattern—researched, among others, by Maximilian Moser from a chrono-biological perspective.¹⁰ During deep sleep, the experiences of the day, which are “deposited” in 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 is thus associated with a new brain structure (although it is still unknown “who” causes this communication).¹¹

The calamity of these discoveries becomes evident in connection with media-psychological research, which shows that in TV addicts (those who watch television for more than 3 hours per day) sleep patterns become dysfunctional and attention deficit and hyperactivity disorder (ADHD) syndrome increases.¹² Then, to combat these attention disorders, which are partly caused by increased viewing hours and other stress factors, medications such as Ritalin are prescribed. Astonishingly, instead of remediating the environment, we medicate, adding another challenge to healthy brain development. Ritalin and other such drugs, according to the latest research, may have negative long-term effects on young brains.¹³

Basic Problems of Brain Research

However helpful the indications that educators can take from brain research, we have to take a critical view of the concomitant dangers. Brain research in general is characterized by three problems: a lack of historical reflection by its protagonists and supporters; the methodological and philosophical problems of numerous experiments; and an image of human beings that is based on brain research and, in the end, a neuro-centrally constricted viewpoint. The head and, in particular, the brain within it reside like a kind of Louis XIV above the rest of the body, the rank and file, in this anthropological panopticon.

Historical Short sightedness

The history of science shows us that the formulation of questions and the central concepts of certain disciplines often consist of thought and interpretation patterns that are characteristic, beyond science, of the culture they constitute; culture and thinking mirror each other. This pattern could be termed a “historical syntax” that leads our thinking and feeling without our consciousness of the pattern itself.¹⁴ This unconscious mirroring asks for critical verification of our historical choices in certain disciplines, insights, and percep-

tions if we wish to understand underlying social trends.

Here is not the place to look into this in more detail. I would like to mention one theory, however, because it concerns a problem of brain research that has consequences for education. If we look at the concepts favored by German language maga-

zines and journals that are meant to exemplify a “brain-accurate education,” we notice an analogy between human and machine. These magazines speak of a “computer” instead of a 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 the “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,” of the “neuron data motorway,” and of the “cabling of brain modules.”

In an increasing number of educational theories and reports, attention to the significance of aesthetics, creativity, unexpected learning results, moral abilities, and open learning processes is replaced by metaphors that equate children and machines. The “information-processing approach” to education prevails.¹⁵ According to these technocratic apologists, we carry a “learning machine” in our heads. They report that, conditioned by visual media, “the head’s neurological cables are being relocated in the PC-Generation,” and so on.

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This use of metaphor is not a simple concoction of the press; a considerable number of brain researchers have initiated this technical vocabulary. Blind to actual brain phenomena, they have introduced terminology regarding the “wiring” and “circuitry” of nerve cells—they have introduced “mechanical clumsiness,” as Friedrich Nietzsche called this pattern of thought and speech. Toddlers with speech defects, for example, are diagnosed with “micro-circuit-dysfunction,” and we see babies as “control groups.” “Neurons fire synonymously” instead of exchanging signals and impulses in mutual rhythm; “synaptic circuitry” takes the place of connections among nerve cells; and “modules” or “clusters” replace organic tissues.

This mechanization of worldview is typical not only of many brain researchers—it is a general cultural habit today. Susanne Wickum-Glinski has shown, for example, through the symbolism of contemporary children’s and teen literature, that the “machine metaphor” found its way into this genre in the 1980s, in non-fiction in particular.¹⁶ Nerves are called “news-nets” or “telephone cables,” the eye is a camera, the sense of touch is described as a “feeling apparatus,” the kidney is a filter or purification plant, the spleen is a dustcart, the spinal disc a bumper, the joints are joysticks, the heart is a high performance pump or engine, the liver a central laboratory, and so on.

A similar mechanization of human beings is found in movies—like “Batman” or “Star Wars”—and in toys and comics. 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 last but not least, videos and cyberspace action games often make use of these mechanized, militarized figures.

At the same time, images of humankind are rapidly degraded by many television programs in which sexual relationships are reduced to “mutual benefit unions.”¹⁷ The postmodern proclamation of the “death of the subject” and the questioning of human individuality—in short, the constructivist interpretation of the world—all belong to this context.¹⁸ The neuro-theoretical debate about free will and mechanical metaphors of brain research appear, in this context, to be symptoms

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Method, Philosophy, and the Human Image

Some brain researchers’ claims that human beings have no free will, such as those of Wolf Singer and Gerhard Roth, have prompted provocative and, therefore, enticing discussions. If, for example, we give a test subject a task in which he or she must make a decision, and we observe brain activity prior to and during the experiment,

we often see, shortly before the (assumed) actual conscious decision, decision-activating impulses arise in deeper levels of the brain. This, allegedly, speaks for a non-conscious “pre-decision” of the brain.¹⁹

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From the perspective of research methods this “insight” illustrates, however, a series of problems. The test subject is observed in the restricted environment of an MRI (magnetic resonance imaging) machine or an EEG (electroencephalogram) cap, and the question remains whether or not a “free” decision is possible under such conditions—or whether the results are methodological artifacts.

Further, if we ask what critics of the idea of human freedom understand by “will,” we usually encounter 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 and unexamined equation between “will” and “conscious decision,” or the opinion that the impetus for free deeds of will can be localized in the neo-cortex). Some researchers whose own results are interpreted in this naïve fashion warn at the same time of drawing too-hasty conclusions.²⁰

The philosophical critique of the hypothesis of the non-existence of free will has been far more comprehensive, however, than the neurological critique.²¹ This is because concepts like responsibility or guilt lose their meaning if decision-making processes are only instigated by unconscious or preconscious brain activity and not, at least partly and temporarily, by a freely deciding individ-

ual. To conclude against free will has considerable consequences for our legal system, for philosophy, and for education. To take only one instance, a leading assumption regarding modern education—that children ought to be guided to develop into autonomous, decision-making, and responsible human beings—would be exposed as an illusion. Indeed, for some educators, a “brain-correct” education already takes precedence over a “child-correct” education. For them, the brain, not the human being, is the appropriate beneficiary of educational endeavours.²²

Besides allegations that some brain researchers’ deterministic hypotheses express a materialist prejudice, observable as a common cultural phenomenon far beyond the areas of brain research, this point of view also receives a fair amount of criticism for its lack of reflection. For example, the philosopher Peter Bieri remarks: “What appears like a sound empirical refutation of free will is a bizarre piece of metaphysics.”²³ Most present discussions generally do not follow the lines of these sharp confrontations, however, but try, rather, to find a middle way. According to this more moderate view, free will or autonomous individuals have long been accepted by philosophy, and, therefore, deterministic brain researchers preach only to the already converted.²⁴

Other critiques of the deterministic hypothesis play different language games (which were basically formulated by Immanuel Kant in relation to the problem of freedom). For the natural sciences, causal and deterministic statements are necessary, except in certain areas like quantum physics. These sorts of statements, and the world-view they evidence, cannot simply be transferred to spiritual scientific questions about human freedom without committing a category error.²⁵

Further, the methodological shortcomings of many studies do not allow a focus on the subject of free will—which is reflected in the framework of historical syntax as simply another view of the world, one that is only replicated here but generated elsewhere. The philosopher Petra Gehring points to this situation by referring to the colorful

pictures of brain metabolism in the title of a critical essay: “It blinks, it thinks: The pictures and world views of neuroscience procedures.”²⁶ Brain researchers are not necessarily to blame for philosophical errors and misinterpretations of their work, in this view; they are simply operating within an accepted paradigm.

Finally, here, the alleged observation of brain activity, which is really only an observation of metabolic processes in the brain—or blood circulation—suffers from the curious fact that it completely overlooks the body below the head.²⁷ But does our thinking activity really take place only in the head? Many brain researchers make this assumption. Manfred Spitzer says succinctly: “Learning takes place in the head.”²⁸ In a lecture at the University of Göttingen in 2006, Wolf Singer emphasizes: “All knowledge resides within the functional structure of the brain.” On the other hand, the psychologist Erwin Straus entitles 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?

Neuro-centric Short sightedness

In order to answer this question I would like to present some findings of a significant research project on the effect of school architecture on adolescents.²⁹ How does perception of a school’s façade or a certain color arise and—this is particularly important for our subject—how does it lead to certain judgments about what we perceive? Is perception a process that takes place only in the brain? Our studies show that this is not the case. Every perception of

a built environment incorporates the activity of different senses; for example, it may involve collaboration among the senses of hearing, vision, and balance. Perception simultaneously connects what we may call outer senses of the body (e.g., vision and hearing) through what we may call inner senses (e.g., senses of movement and temperature).

The cognition of architecture, therefore, involves the whole human body and demands a more detailed analysis of the collaboration of different sense qualities—a synthesis—through

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which we (mostly consciously) perceive architectural structures. An activated field of our senses defines the impression a building makes on us. In our research, we were, for example, able to determine that some students reacted to an environment of “warm” colors (like yellow) with a slightly increased skin temperature in the chest region and to cooler colors (like a whitish blue) with a slightly lower temperature. These warmer or cooler qualities correspond to moods that are provoked, for example, by different colors and room temperatures. It appears that registration of color in the brain leads to an impulse within the “periphery” of the chest that stimulates or inhibits blood flow. These temperature differences are transmitted by thermic receptors to the brain and there connect to the actual sense impression of the object. “Outer” (visual) and “inner” (thermic) impression are joined to form a synaesthetic impression of the quality of a building. Only this interaction between inner and outer senses leads to a positive or negative categorization of the perceived architecture (such as, “It leaves me cold”—“It gives a warm feeling”—“It depresses me”). The senses of temperature and sight collude in forming a judgment.

The senses of sight, movement, and balance work together every time we perceive a building. When we look at something, for example, we actually unconsciously take visual hold of it with jerky eye movements (saccadic movements). These eye movements, aroused by specific building forms in architecture, for example, can be demonstrated visually with the aid of instruments. Similarly, proprioceptors in our muscles and tendons “notify” the brain of specific body movements, even when we appear outwardly still. The unconscious experience of movement within our bodies then connects to the visual impression of the building. Thus, within the whole body of the observer, the impression is created of, for example, a “lively” or “boring” structure. Buildings with various contours and slopes often appear enlivening and are associated with eye movements that follow these different forms. Buildings shaped like a box, for example, tend to appear boring, rigid, or lifeless, and are associated primarily with horizontal and vertical eye movements.³⁰ Judgments such as “this building

appears dismal,” or “this room leaves me cold” are not solely produced within the brain but are based on processes within the whole body.³¹

The importance of processes within the body’s periphery for forming an opinion within the “center” is shown in numerous new studies, including some that use imaginative activities. The Italian researcher Vezio Ruggieri, for example, shows that even imagination of objects is connected to small eye movements, as is actual perception of these objects.³² Ruggieri and various

Swedish psychologists also show that, when we look at grimaces or jolly or sad faces, subtle, outwardly invisible activity takes place in

those muscles that are necessary to bring just such expressions to our own faces.³³

Similar imitation and response phenomena have also been found by others and partly ascribed to the activity of so-called mirror neurons.³⁴ We react physiognomically while observing expressions in others, although we are largely unaware of this activity. Research shows that perception and opinion or judgment formation are accompanied by physiological processes within the whole body, processes that are mirrored by the “inner” sense system in the brain and there connect with the visual or acoustic outer senses to form the experience of the phenomena of perception. This whole body activity alone constitutes complete perception and shows that perception cannot be a process of brain alone.

What is the anthropological significance of this “body response”? In a lecture in the cycle *Foundations of Human Experience* (previously translated as *Study of Man*), Rudolf Steiner points out how deductive perception arises out of the activity of different sense organs:

Someone who perceives a colored circle might say, “I see the color, and I see the roundness of the circle or the circular form.” However, here two very different things are confused. At first you see only the color through the specific activity of the eye. You see the circular form when you subconsciously use the sense of movement and unconsciously make a circular movement in the etheric or astral body,

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thus raising it into cognition. When the circle you have apprehended through your sense of movement rises to cognition, it is then joined with the perceived color. You take the form out of your entire body when you appeal to the sense of movement spread out over your entire body.³⁵

The perception and impact of color exemplifies the perception response model and the participation of the whole body.³⁶ According to this model, colors (and, in the widest sense, all objects of outer perception) are registered in the central nervous system. A visual impression moves from the eye and the optic nerve to the brain. If it were registered only in the central nervous system, however, we could assume that vision would remain an activity irrespective of the act of sight—and would produce a “monotonous appearance.” According to this model, active perception, evaluation, and accentuation (for example, in line with the quality of the experience of warm or cold colors) come about only when an impulse of the central nervous system reaches the periphery, where blood circulation is stimulated and temperature is altered. Through the sense of temperature this peripheral process is “mirrored” in the relevant areas of the brain. The body’s peripheral senses function as a kind of response organ, comparable to the soundboard of a violin, which turns 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 gives us the possibility of a discriminating, accentuated, positive or negative, warm or cool assessment of our world. Neuro-anatomically manifested, sense development is at the same time a development of our ability to form judgments. With this, the neuro-centric shortsightedness 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 it is a miming and synaesthetic perception of our own bodies. We ourselves copy the physiognomy before us—even if we do not notice this—and only this allows us to form opinions and to look at a face not “monotonously” but in lively participation.

The examples here highlight how important it is to look at human beings as complete organisms in relationship with the world and not to become shortsighted by considering only brain processes or cognitive faculties. Brains are important, but we should not mistake them for human beings.

Endnotes

- 1 Brain research, in this respect, confirms Rudolf Steiner’s findings, which were published as early as 1909 in his essay, *The Education of the Child*. See also: Chr. Rittelmeyer: *Pädagogische Anthropologie des Leibes*, Biologische Voraussetzungen der Erziehung und Bildung. Weinheim, 2002, Chapter 4.
- 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.
- 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 Chr. 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), pp. 676–679; also the commentary by G. Miller: “The Thick and Thin of Brainpower: Developmental Timing Linked to IQ,” in *Science* 311 (2006), p. 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.
- 10 M. Moser, D. von Bonin, M. Frühwirth, J. Herfert, H. Lackner, F. Muhry, and Chr. 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. See also M. Moser a. o.: “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 Chr. 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.; also D. A. Christakis, F. J. Zimmermann, D. L. DiGuiseppe, and 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: Rapidfire Culture and the Transformation of Human Consciousness*, New York 1999. ADS: Eine Generation wird krankgeschrieben. Weinheim 2005; J. D. Gray a. o.: "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.
- 14 See in detail: Chr. Rittelmeyer and 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, Introduction. See also Chr. Rittelmeyer: *Kindheit in Bedrängnis. Zwischen Kulturindustrie und technokratischer Bildungsreform*, Stuttgart, 2007, p. 97ff.
- 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 10:00 p.m. 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." Available at: <http://www.apa.org/pi/wpo/sexualization.html>.
- 18 Chr. Rittelmeyer (Hrsg.): "Individualität und Autonomie. Zur Geschichte und Krise eines pädagogischen Projektes," *Themenheft der Zeitschrift Bildung und Erziehung* 46, 1993.
- 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-biological 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; Chr. Geyer (Hrsg.): *Hirnforschung und Willensfreiheit*. Frankfurt/M. 2004; M. Pauen: *Illusion Freiheit? Mögliche und unmögliche Konsequenzen der Hirnforschung*, Frankfurt/M., 2004.
- 22 See J. Giesinger: "Erziehung der Gehirne? Willensfreiheit, Hirnforschung und Pädagogik," in *Zeitschrift für Erziehungswissenschaft* 9 (2006), pp. 97–109. See also U. Herrmann (Hrsg.): *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. See also M. Frank: *Selbstgefühl. Eine historisch-theoretische Erkundung*, Frankfurt/M., 2003.
- 24 This debate was actively ongoing in the 1980s in philosophy (and other disciplines, including education). 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.
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