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Education for (with) evolution (draft)

As a famous philosopher said in one of his latest book: Biological evolution bowls in according to fantastic and tough process of *trials and mistakes*, and without that mistakes, trials nothing would give... Evolution is the main process enabling not only life but also knowledge, learning and understanding. If you are going to comprehend the world of ideas and meanings, free will and morality, art and science, and even very philosophy, without deep and very detailed knowledge about evolution, one of your hands is tied up behind your back (Dennett D.C., 2015, p. 34).

The category of evolution has in this essay the three levels of meaning: (a) evolution of the students (*there are data that our brains are changed under factors of technology and ways of learning and teaching in school*); (b) the need of evolutionary change of the education, its methodology, places of education, and relationship between partners i.e. looking on at education from the perspective of students' learning versus teaching them (*education as an journey from learning to teaching, from everyday knowledge to personal scientific knowledge*) and of course, the change of students' everyday life in school, what is crucial). According to Martha Pennington, changes in education and around education, *which are not revolutionary in nature but rather represent evolutionary trends, are nonetheless fairly dramatic in terms of (1) shifting the center of gravity of the field away from the United States and the teaching of writing to native speakers of English; (2) bifurcating the field into schools with different orientations to written texts and different methodologies for research and teaching; (3) disarticulating writing from reading; (4) raising issues of author identity and ownership of texts; and (5) potentially lowering the status and quality of the teaching of writing (Pennington, 2013).*

The third meaning of education for evolution (c) last but not least, is the evolution of our approach to the environment/milieu – *humanistic and nature* - heavily influencing the children education. The core issue in that aspect is building a strong and incurrent learning community within school (*school learning community*), similar to that one which is surrounding school and students, teachers and parents.

There will be four parts of the presentation: (1) morality and the brain functioning (2) Evolutionary origin of the human beings' cognitive unique (3) Pedagogical conclusion about school learning-teaching technics; (4) Natural pedagogy – is it a new promise?

1. Morality and the brain functioning

One of the most important features of personality is that the personality can not be placed in one area of the brain, and the similar statement we may establish about awareness (Richard Davidson, after: Miriam Boleyn-Fitzgerald, 178). Brain does not accept the dichotomy dissociating *reason* and *emotion*, which has been left in heritage by Greek philosophers (ibidem, 178). There is no one neuronal centre; we could indicate a region exclusively responsible for cognition or for emotion (*Miriam Boleyn-Fitzgerald*, after Davidson, s.178).

Damages of PFC (Prefrontal Cortex) are causing change in moral evaluation by people affected with this. There is well known story about Phineas Gage's accident (1848), his personality has been changed after accident where his PFC has been injured with a metal bar; and the verbal test on evaluation and decision making about switching rail way and kill 1 or 5 persons; and a test with a crying child in basement during the war – child's cry could bring soldiers who could kill several adults in the basement or not if mother clench the child's mouth steels them. In the test on *moral decisions*, people with healthy brain usually were protecting a child against several adults in basement and were going to switch railway onto rail with one person versus this rail where several people could die. But persons with damage of VM PFC (*ventromedial prefrontal cortex*) definitely more often decided, "yes" in both conflicted situations - to save more people (Boleyn-Fitzgerald, 2010, p. 140).

Such brain regions as *nucleus accumbens* and *caudate nucleus* connected to setting of pleasure and reward, as well with processes of memory and learning, and *the island*, responsible for dealing pleasure and basic human emotion (empathy, compassion) gain high level of activity when examining students were getting money from the scientists. What is important, the same brain activity has been observed when later tested students were giving money to somebody else, for devout aims (Boleyn-Fitzgerald, 2010, p. 138). According to Miriam Boleyn-Fitzgerald there is possibility for training our *giving neuronal circles* – i.e. possibility of training of altruism... (ibidem, p. 139). The changes in the structures responsible for moral decision making not necessarily improve qualitatively undertaken decisions. Concrete behaviours are based on struggle behavioural mechanisms where important role is played by a context. It can be seen in teenagers' behaviours when dramatic changes in PFC are disturbing it's functioning what may influence decisions making. We – teachers - should remember about that in our pedagogical activity.

Scans of brain made when people were coping with ethical dilemmas are giving scientific explanation of neuronal decision processes, dealing with moral issues. The neuronal net responsible for disinterested wills to share goods (in this case money) were identified during the research mentioned above. Moreover, those nets maybe subjects for training (ibidem, p. 140).

Gentate gyrus (in hippocampus) being in the centre of neurogenesis is very sensitive on a level of glucoses, because of that, that divided neuronal cells – neurogenesis is happening just in hippocampus - needs more energy. However too high level of glucoses

In blood, much more than normal, may have harmful/damaging influence on the young brain (Scott Small, after: Boleyn-Fitzgerald, 2010, p. 157).

Greene and Cohen (2001; after: Boleyn-Fitzgerald, p. 118) were scanning student's brains when they were solving 60 hypothetical dilemmas, within three categories:

- a) problems without any moral context (*choosing vehicles to travel*);
- b) ethical dilemmas, but not referred directly to examined persons (*rail train switch story...*);
- c) moral problems referred straight to examined persons.

Problems from the last category boosted the brain emotional circles the most.

The results of observation of the concrete neuronal circles engaged in particular tasks indicate that moral tasks not causing personal involvement (impersonal ones) or emotionally neutral were active on the same level like those which were totally without emotional/ethical connotation. It is very important for understanding our morality. We should see ethical mind activity as rooted deeply in biology as a subject of teaching, however during emotionally engaged actions (see: Humberto Maturana's *biology of love*). On the other hand we should be aware that moral evaluation and moral behaviours are not idiopathic and consistent phenomena. They are clusters of intuitive emotional and cognitive reactions, they are functions of many factors (Greene Cohen, 2001; after: Boleyn-Fitzgerald, 2010, p. 120).

We may empower the need for intellectual and behavioural activity of students on the base of the knowledge which we have build on the base of brain functioning analysis, i.e. the need in order to change educational methods used for teenagers for instance. Just now we have in Poland battle about school called *gimnazium* (*junior high school*). Ministry of Education already decided about closing that school...because...they are *ineffective*, students present bad behaviours, very often immoral ones. Not only in our opinion the ways of educating those students should be changed instead of eliminating such school like this. These schools as such/*per se* are not producing students' bad behaviours. Teenagers' brains are not mature and they are functioning in a different way, especially in the field of decision undertaking. The students have to be extremely active – intellectually, socially and physically. And that activity has to be based on *shared intentionality*. Brain regions responsible for short-term memory active during cognitive work submit to muting in the moment of processing emotion by the brain, again we may experience the state that *emotions dominate*. Probably from that statement (or from experience) came into being a saying: *emotion restrict a filed of seeing*. Again, *behavioural activity* is very important for education, for accustoming behaviours according to proper values. We already know behavioural activity is causing change in neuronal circle, on the base of neurogenesis.

However, we may indicate as well possibility of some negative examples of unexpected behaviours of children as the results of physical/intellectual activity in school. This hypothesis may get support from following example that has been taken from Dutch schools and from Santa Claus tradition. In the Netherlands there is a tradition involving the practice of blackfacing, that is, the painting of ones face to resemble a person of African descent. Children are given dark paint to paint themselves in a caricatured dark skin color,

and behave in a silly way; it's very detrimental to the dignity of children with a dark skin color. The phenomenon involves a figure called "zwarte piet" they are portrayed as silly, wild and unpredictable people, in need of the guidance of their white boss (*on the base of relation made by Jennifer van Leijen, Utrecht*).

Moreover, in Langkaer Gymnasium Aarhus, Denmark in 2016, first year students were divided into classes according to ethnic origin. Interesting is the head teacher's explanation of his decision: *it is a way to keep Danish children in the school...it helps us to keep ethnic Danish students and it will result in more differentiated school...* (Gazeta Wyborcza, 13.09.2016). However, one may say that this school practice in the nearest future may prompt as well – *via change in neurons circular in the brain* - bad/racist attitudes towards others.

It is not big revelation/finding, but the behavioural/physical and intellectual students activity may cause bad emotion and socially/morally improper attitudes as well. The mentioned above situation in Dutch schools should be considered on the base of knowledge on brain functioning. One has to be very sensitive to those social activities in schools, which could promote human beings categorization, and at the end of the day the selection, especially just among people in school age. It is rather sad to listen that in Poland experienced teacher, preaches negative opinion about *inclusive education*, and about other representatives of school administration who are about coming back to special schools as the institutions for impaired young people.

We already know that brain functioning of young people especially in the area of moral assessment rely on activity of *amygdala*, the region responsible for primal impulses, i.e. aggression, anger and fear. In adults' brains this kind of information is processed in PFC, where are centres of controlling reflexes and common sense of evaluation of the given situation and surrounding (Boleyn-Fitzgerald, 2010, p. 123). PFC during of growing up is in a state of structural development, because a process of myelination is not ended (ibidem, p. 123). *Neuronal paths* of PFC are leading to emotional brain structures, which are responsible for efficiency of human beings social behaviours. PFC is relatively very big in comparing with other hominids (Churchland, 2013, p. 198). Evolutionary advantages of bigger PFC are giving us better ability to predict events both, in social area and in physical ones. This ability may be useful to postpone gratification and to self controlling (Preus, 2009, after: Churchland, 2013, p. 199). Higher ability to events prediction is going with bigger possibility of manipulation, both social and in physical areas (ibidem, p. 200).

PFC is crucial for higher order activity of human beings. For instance damage in the region of PFC named *orbitofrontal cortex* - **OFC** – round about above eyes, may cause hyper activity, lack of empathy, depletion of aggression in the face of risk, back out in the emotional and social spheres (ibidem, p. 201). However the functioning of PFC is determined by the change of level of dopamine and noradrenalin as well. PFC is very sensitive on the chemical state of these neurotransmitters. In this way, decline of level of serotonin correlates with dismissing of dishonest proposals in transactional games (ibidem, p. 202)

To sum up – taking into consideration what has been said above about relationship between brain functioning and moral behaviour and looking at neurogenesis, we may say that the morality should be thought as well mostly by doing, or even only by doing,

personal experiencing of moral decisions and students' behaviours. First of all, we may found that good examples in the word of Evangel... Moreover, for above forty years ago Heliodor Muszynski in Poland exhorted for such moral learning-teaching activity to be introduced into educational school system in Poland.

And last but not least - we have to remember that some people are aggressive because nobody loved them, first of all parents, another are aggressive due to put out of order of their amygdala (ibidem, p. 125). The problem is the knowledge we educators have about students and their psychological processes and psychological states. This knowledge is important from another crucial in education point of view as well. We are going – whatever to say and whoever is thinking about the human beings future – to build the World full of people, whose ethical beliefs are reflection of **personally confess** human values. Those values are the main aims of moral education. They are in opposition to any *moral truth* given from outside (*not experienced personally, in constructivist way*) and which are given and exactly described with confidently that they should cause given activity/behaviours, in given situations in absolute way, with no exception.

The world with **ethical beliefs** being *reflection of personally confess values, gained as results of practicing moral behaviours* in every day social situations and deeply rooted in awareness and conscience of human being/young people, may become much more happy and peaceful than this world we are living just now in. Did not Christ want to create/breed such World in his teaching 2000 years ago?

2. What is evolutionary origin of the human beings' cognitive unique with their intelligence?

Is it result of the process of adaptation? In some way – the answer is “yes”, but not only. Being just a *clever man* is not more adaptive than to be *a stupid one* (Tomasello, 216), and not because of that - that being clever would be more adaptive than being stupid – people becoming wiser. Herrmann et al (2007; 2010) run cognitive tests among chimpanzees', orangutans' and 2,5 years old human being children. Tests were describing skills of managing in the physical world and in the social one, by the examined subjects. Children and monkeys demonstrated very similar skills in managing the physical world. However, human beings children presented more sophisticated skills of managing the social worlds.

Researchers presented the hypothesis that adults are more intelligent than monkeys in all aspects of life, not because the general intelligence is a result of adaptation, but that human beings as children were growing up using their special skills of social cognition to cooperate, communicate and social learning with/from another members of their culture, including using all artefacts and symbols (Hermann, Tomasello, 2012). On the other hand an opposite statement well founded (informed) like statement above. The big brain opened space for diversity and plasticity of behaviours, which were leading to complicated social structures, with many mutual relations between people. Both factors forming the human being – culture and biology are mutually interacting. *Gen-culture coevolution* seems to be the biggest power of our humankind.

There is strong evidence that the language is the key instrument for human undergoing cognitive evolution, but the language is the culmination rather than the fundament for the process of cognitive evolution (Tomasello, 2015, p. 220). The human beings thinking was

unique before cultural differentiation has been developed (i.e. cooperation skills, cooperative communication, and shared *intentionality*). The skills mentioned above, **enabled evolution** and cultural development in the later time (ibidem, s.221).

According to Carruthers (2006; after Tomasello, 2015) additional modules in the brain/mind were added during the evolution, between them the most important are: *the systems of identifying others' psychological state* – i.e. *mind reading system*, language learning and normative/prescriptive reasoning. Following that theory Mithen (1996) who is building *modular evolutionary theory* of human beings cognition connects this theory with a track of human beings' hands products (after: Tomasello, 2015). Early men was having several cognitive modules, which were not integrated (by the way: *the modular theory of evolution is criticised by some evolutionists, see: Heller and Życiński, 2016, p. 307-309*). Contemporary people due to symbolic and language skills may operate on integrated cognitive modules (p.225), what is giving them tremendous *intellectual power*. However, we should remember that important is here the difference between *early people* and *contemporary people*. This caution should bring us to culture and integrations between culture and gens (see: Heller and Życiński, 2016, p. 308)

Researchers from *Emory Paleolithic Technology Laboratory* were teaching students forming Palaeolithic tools - *bifaces*. They were analysing the activity of students' brains and tried to understand in what way our higher cognitive abilities were evolving.. The researchers observed the growth of the students' brain structures reasonably when they improving forming tools techniques. *Scanning techniques reveal how more of the brain gets used as tool making becomes more sophisticated* (Stout, 2016). However, there is evidence, apart from above research statement, that the key instrument for human beings cognitive evolution was cooperation between people in order to gain common goals, with *common attention* (Tomasello, p. 229). Ability to assume/read *intention of others* (*what is connected to common attention*) i.e. members the cooperating group was crucial in that evolutionary process. Therefore, *shared intentionality* of human beings caused transformation/socialization of all processes of thinking and the *individual intentionality* (ibidem, p. 229).

According to Michael Tomasello, all theories of human beings evolution accept one the same statement: *evolution is going in general direction towards the growth of the cooperation level* – at least to 10 000 years ago (ibidem, p. 230). And this statement is critical for school education in the context of cognitive evolution, and not only in that context. Gowlett et al (2012), following Dunbar's assumption (Dunbar, 1998) about *social brain*, were tracking the connection - during the human evolution - between the size of the brain and amount of human beings population (see as well: Dunbar, 2014, p. 97). They discovered the big jump for strong correlation between the *size of brain* and the *amount of human population* (400 000 years ago) and what is important, it happened (these correlation) exactly in time of *homo hidelbergensis* (after: Tomasello, 2012, p. 232). Michael Tomasello comments the statement mentioned above, that it was when the first stage of evolution of human beings thinking was going due to *shared intentionality* (ibidem, p. 232) and that this correlation (between *size of brain and amount of population*) is only very general clue about the processes placed on both sides of the correlations (*size of the brain and amount of human population*).

Kim Sterelny (2012), being concentrated on human cooperation, proposes concrete try of describing the connection of *human beings sociality* with *cognitive processes* (after: Tomasello, p. 232). Sterelny propound the hypothesis that *cooperative style* of life of human beings depends on the individuals who are *acquiring great amount of information* (about many aspects of living) in a time of their personal development and who are imparting that information to children. That information are/may be crucial for those children to survive (ibidem, p. 232). Therefore we can easy identify the way of building *teaching environment*, and going further, the learning-teaching methodologies, where children may gain information and build the knowledge, allowing them to survive and develop and build/change their further *personal scientific knowledge*.

3. Pedagogical conclusion about learning-teaching technics

If we – teachers and educators working in schools and universities - declare to teach students how to solve contemporary problems of *our world*, we must teach this students how to cooperate effectively, not by talking about *what to do*, but lead students in pedagogical situations and inspiring them for effective and properly organized cooperation for learning i.e. solving *experienced problems*. The student's activity is important as well in context of developmental change. The brain neuronal net being constructed in age of 10-17 can not fully *relay* - in the process of decision making - on behavioural patterns imparted from outside. This net may safely solve problems mostly on the base of on going analysis in the local context. Therefore, cooperation in peer group on this stage of development is the most important (and safe) way of building and verification of ideas and attitudes.

The only effective way supporting *deeper learning* and understanding of the world is personal activity, coping with the hard enough difficulties and overcoming them. Only these pedagogical aids effectively boost neurogenesis (Shors, 2009; Vetulani, 2011). We may assume – after all what has been written in here about evolution and relations between the structure of the brain and human beings morality, the neurogenesis can be treated as one of the main mechanisms for cognitive evolution. The knowledge and skills how to teach (or better: *awareness of...*) we already gained as well, by analysing human brain biology and studying the brain functioning. Moreover, we have to take into educational consideration the learning-teaching environment more seriously, not only what is in the class/school by as well what is around the school. There is enough evidence which allows us to tell that environment of learning-teaching is equally educative than very methods of teaching.

What kind of pedagogical/educational situations created by using learning-teaching technics/methods we collected during developing our teaching methodologies in school and out of school? Which one of them could be useful in doing tasks supporting cognitive development and further cognitive evolution? In the past were created a lot of them... First of all we mean about methodologies based on love... There are those based on communication, dialog, independent/free activity, and cooperation within the group, from the position of *one of the group members* not just from *the position of the only "SELF"* in the group. Implementing that methods means first of all to inspire students to *shared intentionality*, to looking for others' mental and emotional assumptions, and appreciating students by teachers as partners in building their personal knowledge and skills, in school and *out of school* activity.

Learning-teaching techniques based on love – especially on Humberto Maturana’s idea biology of love (*appreciation/respecting students every day knowledge in the process of building their personal new knowledge (Wonder Tree SelfDesign School, Canada); assuming students’ good will – Rudolf Steiner School; taking care about students’ childish/ childishness [kind of being fresh in ideas, reliance, cognitive openness....]; inquisitivism... learning for depth...(Kieran Egan);*

Learning-teaching technics based on activity – equally: intellectual and physical activity (*learning by doing; performing/creating; investigating/inquiring; exploration...; new educational interfaces – Institute of Play (New York); and schools in New York and in Chicago based on students playing and designing games; Arthur Morgan School, USA,NC*

Learning-teaching technics based on cooperation (*mutual teaching – mentoring, as well; working in pairs...debates; dialog; Jena Plan School, Efterskola in Denmark; Atlantic College, Wales, UK*

Learning-teaching technics based on art (*playing drama; creating art-scientific models; playing music; writing music; declamation... Davidson Public School, USA, NC; Cathedral School in Poznan, Poland.*

4. Natural pedagogy: is it really a new promise?

Is it our expectations, after experience of many ineffective educational technics? Is it a new wave in educational methods or even pedagogy based on hypothetical evolutionary processes? Going to summarization of this paper we are coming to vote for a kind of *natural pedagogy* According to Gergely and Csibra natural pedagogy *is likely to be human specific: while social learning and communication are both widespread in non-human animals, we know of no example of social learning by communication in any other species apart from humans. Second, natural pedagogy is universal: despite the huge variability in child-rearing practices, all human cultures rely on communication to transmit to novices a variety of different types of cultural knowledge, including information about artifact kinds, conventional behaviors, arbitrary referential symbols, cognitively opaque skills and know-how embedded in means-end actions. Third, the data available on early hominin technological culture are more compatible with the assumption that natural pedagogy was an independently selected adaptive cognitive system than considering it as a by-product of some other human-specific adaptation, such as language. By providing a qualitatively new type of social learning mechanism, natural pedagogy is not only the product but also one of the sources of the rich cultural heritage of our species.*

Sashank Pisupati added, that *babies seem to have a “pedagogical stance” or an instinct/willingness to learn. They are sensitive to certain cues such as direct eye contact, infant directed speech, pointing, gaze direction and gestures. In response to these directive cues, they seem to be inclined to learn and generalize rules very fast. This may be the mechanism by which they pick up elements of language with very few training examples. Natural pedagogy may have evolved when early hominin started using tools (Pisupati, 2011).*

Andrew Whiten et al. in the book *Culture evolve* are certifying that *the sense of ‘culture evolves’ refers to the emergence and nature of cultural processes and capabilities in the animal kingdom. Moreover, the sense of ‘culture evolves’ widens to embrace the evolution of*

culture and its products per se, because a distinctive hominid development is that culture has become cumulative, with progressive changes building on previous generations' achievements. Today, such accumulation is evident within our lifetimes, as exemplified by digital technology and genetic engineering.

Merlin Donald explains the evolution of humans' uniquely collective mind, on the base of culture development. *Our conscious capacity provides the biological basis for the generation of culture, including symbolic thought and language. Conversely, culture also provides the only explanatory mechanism that can unlock the distinctive nature of modern human awareness. Without deep enculturation, we are relatively helpless to exploit the potential latent in our enormous brains because the specifics of our modern cognitive structure are not built in. Our brains coevolved with culture and are specifically adapted for living in culture—that is, for assimilating the algorithms and knowledge networks of culture. In a sense, our brain design 'assumes' the existence of a cultural storage mechanism that can ensure its full development. Human culture started with an archaic, purely non-linguistic adaptation, and we never had to evolve an innate brain device for language per se or for many other of our unique talents, such as mathematics, athletics, music and literacy. On the contrary, these capacities emerged as by-products of our brain's evolving symbiosis with mind sharing cultures. Language emerges only at the group level and is a cultural product, distributed across many minds.* I do recognize in these statements clear connections to Michael Tomasello's opinion about language as the culmination rather the fundament of human beings cognitive evolution and the role of *the shared intentionality*.

Enoch Lambert, Lindsey J. Powell and Katherine McAuliffe in *The Origins of Pedagogy: Developmental and Evolutionary Perspectives* referring themselves to cognitive evolution of human beings are writing: *It is important to note that in arguing for an evolutionary perspective on human teaching, we are not endorsing a narrowly adaptationist approach. Rather we aim to delineate the numerous ways in which our evolved cognitive architecture might support active forms of social learning. We find it premature to favor one or another alternative based on the evidence available at this stage, but aimed to identify key distinctions and open questions, and suggest ways of distinguishing between these viable alternatives. Characterizing the evolution of the human mind will involve integrating theories and findings from evolutionary biology, comparative and developmental psychology, cognitive neuroscience, and computational modeling to understand how natural selection shapes neural systems to solve fitness-relevant problems in their environment* (Skerry et al, 2013).

May be we - educators should **stop working on detailed teaching methodology**. It seems to be impossible to build such methodology enough differentiated to satisfy the recognized needs of all students – I mean - of each one...

May be we - educators should **look for general** and **natural strategy** referred to children's natural curiosity and tendency to imaginative, creative and cooperative activity, what would be close to knowledge about the brain functioning and our knowledge, and experience withdrawn from cognitive evolution...

Education is a result of evolution and depends on cognitive evolution ... Thou today's educational environment (context) is very different from that from before millions years

ago; the basic principles of learning and teaching in their core were/are all time the same. May be we do not need a new pedagogy, but we just need to implement those principles, which gave humankind so tremendous intellectual power during the evolution process....

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