Interrelations between the brain, psychological stage development, and societal evolution

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Abstract

Brain researchers are required to study Piagetian cross-cultural psychology, the second branch of cross-cultural psychology, following psychometric intelligence research. According to empirical data collected in over one thousand studies conducted throughout the world, pre-modern peoples do not attain the adolescent stage of formal operations typical of modern peoples. The divergent developmental courses concern the whole range of personality development across all logical, physical, social, and moral dimensions. The presented data on divergent psychological developments between pre-modern and modern peoples are relevant for an encompassing understanding of the history of culture, society, religion, philosophy, morals, law, and politics. Links must exist between these divergent developmental paths and the corresponding cerebral structures that carry the respective psychological stages. This paper presents these interrelations to the extent that they are known, such as neocortex development, brain lateralisation, and density and number of nerve cells and synapses. Brain research can deliver decisive contributions to the explanation of both the arrested development of pre-modern populations and the very slow psychological progress during the several phases of societal evolution. The new theory offers new directions for the international brain research that focuses the role of impoverishing and enriching environments on ontogenetic brain developments. While it considerably deepens the milieu theory of brain development, it tends to dwarf those approaches that emphasise the permanent and unchanged state of the brain since the Pleistocene.

KEYWORDS: developmental psychology, psychological stages, brain lateralisation, neocortex, social evolution, pre-modern society

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Introduction

Research into the link between the brain, psychological development, and culture has a long history. Older and racial theories maintained that the various human races would stay on different, higher or lower, steps of the ladder, which connects the evolution of humans with that of apes and other mammals. Consequently, they regarded the brains of the different races as manifestations of their evolutionary and anthropological level and as the main cause to the respective stage of civilisation and culture the races had accomplished. This idea was widely abandoned by 1945 but persists somewhat (Lynn 2006).

Most current brain researchers research in other directions usually without discussing or touching the racial questions. They usually interpret human capacities in terms of evolutionarily selected traits, manifested and controlled by certain brain functions. Very frequently, they maintain that the human brain has not changed, at least not remarkably, since the Pleistocene. Thus, they emphasise that modern humans master their lives with a brain and a psyche that is typical of Stone Age hunters. They describe behaviour patterns regarding aggression, sexuality, social relations, etc. as brain manifestations that are believed to be universal across times and cultures. The tendency to see the human brain as a constant and unchangeable biological machine, controlled only by genes, is widespread at present (Allman 1994; Diamond 1992; Roth 2003); evolutionary psychology or sociobiology are specific parts of this trend. This tendency implicitly or explicitly ignores racial theories and all other theories that maintain brain differences across history and cultures. This trend reflects the preponderance of the idea of the universality of the humankind, as it evolved after 1945 and especially after 1980. This idea of universality is by no means new but has radically removed the older and alternative idea of a psychological evolution of mankind, which was influential or even prevalent by 1945/1980. The replacement of older traditions, such as evolutionary cultural anthropology, with the idea of the universality of mankind across all social sciences and humanities has had strong effects on trends and ideas within the brain research industry (Oesterdiekhoff 1997, 2000, 2009a, 2011, 2013).

However, aside from the racial and the universalistic approaches, there is still another theoretical possibility of combining the brain, psychological development, and societal evolution, with brain research, developmental psychology, and historical disciplines, respectively. Leading researchers in several disciplines since the era of Enlightenment have contended that humankind has gone through several stages of psychological development. They have described how ancient humans were considerably different from modern ones and were at lower stages of psychological development. They tried to explain it not by racial or biological terms but by a theory that envisages a causal interrelationship between culture and psyche, socialisation and development. They described archaic or primitive man as a childlike man, whose living conditions did not compel him to develop beyond that state. Additionally, the psychogenetic evolution that led to modern man was said to be drawn by cultural influences, such as schooling, job enrichment, and further factors. These approaches thus described a psychogenetic evolution from primitive to civilised man. Leading scholars such as Comte, Spencer,

Tylor, Frazer, Cassirer, Luria, Blondel, Murphy, Allier, Janet and many others, supported such views (Oesterdiekhoff 1997, 2000, 2009a, 2013b).

Even the first child psychologists saw the resemblances between children and primitive men and described them at length. It seems that in fact every early developmental psychologist emphasised these resemblances, e.g. Hall, Wallon, Baldwin, Sully, Preyer, Stern, Piaget, Zeininger, Jaensch, Descoeudres, Krüger, Werner, Schultze, etc. (Oesterdiekhoff 1997, 2000, 2009a, 2011, 2013b). Werner (1948) was the first to completely evidence the structural identity of children and primitive men regarding every aspect of cognition, volition, and emotion in one comprehensive monograph.

The related empirical psychological research of the 20th century confirmed these early theories, although the ruling ideology of the universality of mankind has been very successful in preventing these insights from becoming known to greater audiences. I have outlined that it is impossible to understand the history of humans, population, economy, society, culture, politics, sciences, religion, philosophy, morals, etc. without reference to this psychogenetic evolution (Hallpike 1979, 2004; Oesterdiekhoff 2013b, 2011, 2009a).

These facts confront brain research with new ideas. No psychological development from childhood to adulthood occurs without a corresponding brain development. Brains from pre-modern humans have to differ from modern humans in terms of psycho-neurological development. However, there are some research traditions and known facts in brain research that have already confirmed these developmental approaches. This article aims to analyse and to discuss these phenomena. It seems that brain researchers should study and examine these new directions in the future.

Brain, socialisation, and environment

Evolutionary psychology and sociobiology deal with behaviour patterns and social consequences stemming from the brain having evolved in the Pleistocene era and remaining more or less stable since that time. However, brain researchers also know the alternative perspective to look for the divergent environmental conditions in which brains grow from birth onwards. They know that human brains do not unfold their full capacities when exposed to environments with deficits such as malnutrition, a lack of maternal care, low social and intellectual stimuli, missing elements of education and media. Brains exposed to high degrees of fruitful stimuli grow bigger and divergent from brains in underprivileged milieus. Brains born into underprivileged milieus can surmount their early deficits somewhat when they migrate into more favourable milieus in time. However, if the milieu change comes too late, the deficits threaten to persist throughout a person's life; the window for developmental transitions is closed (Swaab 2013; Hüther 2013; Bauer 2004).

Training and mental activities of animals and humans cause an increase of nerve cells and synapses, thus an increase of the weight of the brain. Animals and humans changing from impoverished to enriched environments within a few hours activate more than 15 genes that arouse the increase of nerves and synapses. Afterwards, their intelligence arises (Bauer 2004).

Consequently, brains in different cultures, social milieus, and educational backgrounds develop divergently. Human brains exposed to modern cultures with eight or thirteen years of school attendance (and sometimes followed by years of university studies) develop divergently from brains raised in societies of hunters and gatherers, peasant societies, ancient civilisations with high rates of illiteracy, or in societies such as the Western countries as they had been 100 years ago with only a few years of school attendance and weak curricula, at least in comparison to current standards (Singer 2002; Swaab 2013).

Developmental psychology and brain research

Human brains need two decades or more to develop their full functions. The ontogenetic growth of the human brain is the ultimate basis for the development of psyche and personality, intelligence and cognitive functions. Therefore, the growth of the brain is the material basis for the psychological development from birth through childhood and adolescence to adulthood. The differences between neonates and children, between children and adolescents, and between adolescents and adults are mainly differences in the maturity of the brain. Children with immature brain functions remain in lower psycho-neurological or anthropological stages and think and behave divergently compared to adolescents and adults with more developed brains. Consequently, adults are more distant from the stages of apes and mammals than children are because only adults have fully developed human brain functions. Alternatively, in other words, children are children because their brains have an immature status (Werner 1948; Bühler 1930; Piaget & Inhelder 1969; Case 1999).

Jean Piaget developed the most elaborated theory of human development thus far, stating that it mainly unfolds in four stages. The sensory-motor stage is followed by the preoperational stage, then by the stage of concrete operations and finally by the stage of formal operations. The first stage lasts to the 18th month of life, the second one to the sixth year, the third one from the sixth to the twelfth years of life, and the fourth stage unfolds step by step between the tenth and twentieth years of life. It is obvious that certain stages of brain development carry these four stages. The four psychological stages correspond to four stages of brain organisation (Piaget & Inhelder 1950, 1969; Inhelder & Piaget 1958;Mogdil & Mogdil 1976; Bühler 1930; Vernon 1984; Case 1999).

In 80 years of research and more than a thousand empirical studies on all continents and in many cultures, Piagetian cross-cultural psychology has determined that adult members of pre-modern societies usually do not develop the stage of formal operations but remain bound to the second and/or third stages of psychological development. Some pre-modern populations mainly stay on the preoperational stage, and many others stay both on the preoperational and concrete operational stage, depending on both tasks and population percentages. Half of the populations of the most advanced societies occupy Stage A within the formal stage, and the other half attains the more-developed Stage B at this final stage. These results are valid across the entire range of psychological development, cognitive functions, and world experience. The tests regarding the examination of logical, physical, social, and moral issues match to this

cluster the same way (Ashton 1975; Hallpike 1979, 2004; Mogdil & Mogdil 1976; Dasen 1974, 1977; Berry & Dasen 1974; Eckensberger et al. 1979; Poortinga 1977; Luria 1982; Oesterdiekhoff 1997, 2009a, 2011, 2012,a, b, 2013a, b).

Therefore, adults of pre-modern societies usually do not surmount the psychological levels of children aged 8, 10, or 12, while modern adults cover levels ranging from 12 to 20 or more developmental years. For example, children and pre-modern adults do not master logical conclusions such as syllogisms. Both groups share the same physical concepts and the same categories of causality and chance. They share animism, magic, and conceptual realism. They share the same ideas regarding dreams, shadows, ghosts, and myths. They have the same ideas regarding morals, e. g., they share forms of objective responsibility (people should be punished when involved in damaging consequences irrespective of motives), eternal status of rules, and support severe punishments. The worldwide pre-modern practice of ordeals originates in children's belief in immanent justice (Hallpike 1979, 2004; Luria 1982; Luria & Vygotsky 1992; Oesterdiekhoff 1997, 2000, 2002, 2007a, b, 2009a, b, c, 2011, 2013a, b; Piaget 1932, 1959, 1974, 1975a, b; Werner 1948, Zeininger 1929; Schultze 1900).

It is not the place here to document these parallels. I have worked out in 11 books and numerous articles that there is no detail that child psychologists have documented as typical for children that is not also characteristic of the psyche of archaic, ancient, and pre-modern man. This fact may be astonishing for contemporary scientists, but it belonged to prevailing ideas and knowledge of scientists before 1945/1980. Both ethnologists and developmental psychologists but also sociologists and historians knew something about these parallels in former times (Jaensch 1923; Kearney 1973; Oesterdiekhoff 2012b; Schultze 1900; Tylor 1871; Werner 1948; Luria & Vygotsky 1992).

The second branch of cross-cultural psychological research found results that completely match to this conclusion. Psychometric intelligence research has discovered that in the Western nations in the past 100 years the average intelligence quotient has risen by more than 30 points. This effect, called the Flynn effect, is also discernible in all other continents and describes the impact of modernisation on the world population's intelligence. Thus, there is not any pre-modern people, regardless of race, region, and culture, that has an intelligence quotient beyond 75 compared to current adjustments. Intelligence psychologists have known since the days of Binet that children exposed to adult tests also score between 50 and 75, depending on of their age. Consequently, lower intelligence scores match to lower Piagetian stages and thus, to a childlike psychological summit. Therefore, the higher scores fit the formal operational stage and adult anthropological stages (Flynn 2007; Maistriaux 1955; Oesterdiekhoff 2013a: 49-78, 2012a, c, 2013a; Oesterdiekhoff & Rindermann 2008).

Psychological stages and brain development

Some researchers have documented that the divergent psychological stages people of different cultures occupy are linked with divergent neurological structures. Many researchers thereby often focus the degree of lateralisation of the brain as a phenomenon

connected with the psychological stages. Left brain dominance is said to be connected with logical thinking and formal operations, right brain dominance with fantasy, trance, and preoperational and concrete operational thinking (Vernon 1984; Eccles 1994). The left brain dominance in modern cultures is not a given at birth or in early years but develops stepwise in ontogenesis. 'However brain lateralisation is incomplete until between the 5th and 10th year, when all the nerves to the corpus callosum become mylinated' (Vernon 1984: 441). Consequently, when pre-modern peoples are not exposed to schooling and stop their mental age below the eighth year, their lateralisation then develops earlier and different from modern peoples. Therefore, their lack of left brain dominance is linked to their childlike anthropological stage. Brunner-Traut (1996) based her thorough study on the ancient Egyptians on these research materials, documenting links between right brain dominance, preoperational thinking, and ancient culture.

Of particular note, Jaynes (1993) wrote an influential book on these coherences; he maintained that the two brain hemispheres had been more independent from each other in ancient cultures. The right brain was the place of hallucinations and divine orders, spirituality and authority, becoming active in every unusual situation. Ancient humans saw and heard the gods as real voices and images, a trait nowadays only common among schizophrenic persons. The left brain was correspondingly not as developed as it is in modern societies. Jaynes' book excels at referring to a broad range of related items, such as hypnosis, mental disorders, religion, and ancient customs. However, his argumentation is not strong enough, the reference to the facts of brain research is too weak, and his theory lacks the systematic character it should have. However, it may be a good starting point for further research. I consider the core of his theory to be correct, although it lacks the truly necessary developmental perspective to which I refer. Moreover, the lateralisation of the brain is only one among many other aspects of brain development in ontogenesis and history and is far from being the main material basis to psychogenetic development.

Eidetic organisation of perceptions, images, and memory

Children and archaic humans share some basic traits regarding memory, perception and ideas. Their organisation of ideas and perceptions diverges from that of civilised, modern adults. The highly developed psyche knows a strong differentiation between perception and ideas. Perception represents sensory pictures from the environment, while ideas have no reference basis to external stimuli but refer to contexts of considerations, judgments, and theories. The psyche of children and pre-modern humans has not attained this strict separation. Their perceptions have subjective ingredients, while their ideas have sensory parts. Their psyche has not elaborated the high level of differentiation so that the differentiation between ideas and perceptions is on a lower level as among civilised adults. Researchers call the primitive organisation of perception, ideas, and memory "eidetic" (Allport 1924; Jaensch 1923; Luria & Vygotsky1992; Doob 1974; Peck & Hodges 1937).

According to E. R. Janesch's definition, eidetic images occupy an intermediate position between sensations and images. They resemble after-images in the sense that they are literally seen; they resemble memory images in the sense that they are rich in

detail and possess a certain degree of motility. The eidetic individual is able to project his image, which is perceptual in character. The image appears just as real to him as if his senses were actually being externally stimulated. This subjective phenomenon may be found in the visual, auditory, tactile, and olfactory fields (Peck & Hodges 1937).

Usually, such persons see the eidetic image in the plane of the background or between the ground and the eye. The image is always localised. When the persons are in the dark or when the eyes are closed, the eidetic image is still projected; it is never only in the head. Every arousal of an eidetic image is preceded by a brightening of the visual field, which is identical to retinal light. People are able after hours, days, months, and years to reproduce an eidetic image with all its vividness. In extreme cases, they approach the character of true hallucinations (Allport 1924; Doob 1974).

After being shown a real picture for 30 seconds, eidetic persons see the image on the screen with all details they can describe. They can also describe these details they had not paid attention to when exposed to the real picture. They can describe the tiniest details as if they were still observing the picture. It is clear that this eidetic capacity is rooted in certain brain structures and not merely in psychological phenomena; 'The physiological basis of such a memory is clearly the inertia of the stimulation of the optical nerve, which lasts after the effect of the original stimulus has ceased' (Luria & Vygotsky 1992: 53).

The eidetic capacity carries the peculiarities of memory mechanisms. Four-year-old children win against adults when playing the game Memory, in which pairs of pictures have to be clustered. The searched counterpart lies upside-down among many other cards. Children are better at memorising where the desired picture is to be found. Mentally disadvantaged children are especially good at memory and vision:

> Here we see that the percentage of normal vision in idiots is 3 & ½ times greater than in normal children, while the visual acuity of idiots is on average twice as great. Moreover, the percentage of normal vision of average acuity tends to decline with the transition from idiots to lesser degrees of retardation, and to normal children. This means that in respect of vision we find a process that is contrary to what we would expect: the more severe the retardation, the better the main physiological functions … We have grown accustomed to believing that all the intellectual functions of all retarded children are of necessity impaired. Yet retarded persons, such as imbeciles, often impress us with astonishing powers of memory. We know of instances in which a retarded child has proved able to mechanically memorise quite long passages of text while showing no sign at all of understanding them. This did not, however, happen all the time. Whenever it was not sufficient for the imbecile to imprint on his natural memory the proposed material, which was incomprehensible and of interest to him, whenever he was required to make an active effort to master the proposed material, his memory turned out to be very poor, in fact almost non-existent (Luria & Vygotsky 1992: 156)

Idiot savants have damage in the left brain that leads to a disconnection between the two hemispheres. When the damage takes place early in life, they then develop unusual

faculties such as mechanical and boundless memory. Some of them read hundreds of books with a full memory of every page. They learn telephone directories by heart in one rapid reading without forgetting any details. Some researchers maintain that every brain would have this capacity if higher functions did not develop. The emergence of left brain dominance, operational thinking, and mature psyche suppresses and annihilates these capacities. Thus, primitive humans on very low intelligence levels should always have this capacity (Swaab 2013).

Ethnographers and observers throughout the world have reported exactly this fact across primitive tribal societies across the continents. These features are typical of Australian Aborigines, to the natives of America, and to some Black African peoples as they lived under traditional conditions. Spencer and Gillen, Dobritzhoffer, von den Steinen, Roth, and David Livingstone are only a few of the many experts who have documented these characteristics. The Aborigines of Queensland can recite songs lasting over five nights without making any mistakes regarding the original content. Moreover, they reproduce these songs in foreign languages they do not understand. They have once heard these songs and memorise them without fault although they do not understand the meaning of the words, as W. E. Roth determined. The same phenomenon is being reported from natives of both North and South America, according to von den Steinen (Lévy-Bruhl 1921). This is reflected in the oral poetry of ancient Greece, such as *The Iliad* or *The Odyssey*; singers reproduced these songs over centuries by memory, before the epics were written down.

The same pattern is found in the topographical orientation of natives. Even in the darkest jungle, in which Europeans immediately lose their orientation, the natives find their way because they know every detail even then when they had been on this path only once in their lives; 'It is sufficient for North American Indians to be in a place just once in order to have a perfectly accurate and permanently indelible picture of it' (Luria & Vygotsky 1992: 51). They can travel hundreds of kilometres down a river but remember every corner and every single detail on the shores they had seen years before (Jaensch 1923; Lévy-Bruhl 1921).

The resemblances between the eidetic memory of the natives and that of idiot savants are striking. Both groups manifest IQ scores of around 60. They may differ in many areas, but their commonalities regarding IQ and the eidetic organisation of memory, perception, and ideas are by no means accidental. The eidetic organisation of perception, representation, and memory is strong among preschool children in modern cultures and dilutes with age. It matches to the facts when we hear that 'on the whole, investigators generally accept Roessler's six-year-old age level as the peak in frequency of eidetic ability' (Peck & Hodges 1937: 142). Children this age score with 60 as natives as do mentally disordered persons. The rise of abstract thinking and formal operations removes this organisation. During adolescence in modern society, the final traces vanish. In modern societies one hundred years ago, this phenomenon lasted for longer during adolescence than today. Moreover, traditional groups or uneducated ethnic groups conserve it stronger than advanced groups. Thus, the eidetic organisation demonstrates the childlike

anthropological nature of pre-modern man. Furthermore, it is obvious that certain brain functions are involved in this phenomenon and that changing brain functions account for the disappearance of it. In particular, the emergence of the fourth stage of formal operations causes the reorganisation of the psyche and the disappearance of eidetism (Jaensch 1923; Luria & Vygotsky 1992; Peck & Hodges 1937; Allport 1924; Doob 1974).

Brain and religion, especially experiences with ghosts and divinities

Jaynes (1993) documented that ancient peoples experienced their divinities by all their senses as concrete beings and objects. They did not believe in their gods but saw and listened them physically. Ethnographers all over the world reported this phenomenon the same way. Everett (2008) writes that is common among the Pirãha, a native tribe in Brazil, to visualise collectively a ghost where Europeans see nothing. The natives, however, see the ghost and describe it. Lévy-Bruhl (1983) reports similar situations. To present one detailed report, thirty Black Africans see the metamorphosis of a woman into a hyena. They see her legs as such of a hyena, while her upper body parts remained human for a while. The European bystanders listen to the cries and observe the behaviour of the native eyewitnesses according to them they really see (hallucinate) a metamorphosis. These phenomena are by no means unique but typical to native tribes all over the world. It is reminiscent of the illusions, visions, and hallucinations of children who see ghosts, witches, and angels when subjected to stress in darkness or elsewhere. Children throughout the world share this characteristic to see and hear phenomena that actually do not exist, especially when they are alone in dark rooms or forests. Children's tendency to entertain relations with illusionary companions to whom they talk and of whom they receive suggestions is part of their fantastic understanding of reality. Some researchers contended that the phenomenon of illusionary companions sheds light on the psychology of archaic religion. When adults speak to their gods, listen to their voices, and see them physically, they do the same as children do when they really believe that their companions talk to them (Arieti 1995; Oesterdiekhoff 2007b; 2013b; Stern 1924; Werner 1948; Zeininger 1929; Wooley 1997).

Ethnographers have often described that archaic humans communicate with gods the same way as they communicate with real humans. For example, the research into ancestor worship has accumulated masses of related data. The belief in the divine status of deceased humans, such as father, mother, grandfather, grandmother, dead uncles and aunts, is found among all pre-modern societies around the world except for some Islamic and Christian cultures. Every tribal society and every pre-modern civilisation such as China, India, ancient Mediterranean cultures, Black Africa, and Native America have cultivated ancestor worship, usually more than the cults of other divinities. Commonly, the historical and ethnographical reports document that these people experience their deceased ancestors as speaking, listening, and acting humans the same way or nearly the same way as if they were actually present as bodily persons. Therefore, they do not only *believe* in the immortality of the dead but *experience* their enduring existence through

all their senses. Henceforth, it is not possible to discuss with these peoples about the *probability* or the debatable *status* of the permanent existence of their forefathers because they really know about their permanent and thus true *existence* (Oesterdiekhoff 2011, 2013b; Tylor 1871; Lévy-Bruhl 1971; Frazer 2010; Lienhardt 1987; Middleton 1999).

Consequently, it is necessary to suppose a psyche and a brain that are different from that common to humans of modern societies. Pre-modern humans have a psyche that is frequently and easily capable of hallucinating images and voices of people, especially of people to whom they have experience tight relationships. Jaynes (1993) writes that modern humans hallucinate voices especially of related persons when they are exposed to extreme stress situations. We know from World War II soldiers that they saw their mothers in front of them in deadly and dangerous situations. Jaynes says that archaic humans had hallucinations in every unusual situation not only in stress situations. Ethnographic descriptions from all over the world exactly report this phenomenon.

Many historians and philologists, such as Doods, Jäger, Fränkel, Snell and others have confirmed Jaynes' observation that the ancient Greeks see and listen to the gods physically. For example, *The Iliad* presents the relations between gods and humans as physical interactions; people explain their own actions as made by gods. They execute what the gods have decided and prepared for them. The gods are essential to the persons themselves (Herbig 1991; Snell 1975; Doods 2004; Oesterdiekhoff 1997, 2009a). Jaynes (1993) refers this phenomenon of divine influence on human actions to the bicameral structure of the ancient psyche, where the right hemisphere sets forth the hallucinations, while the left hemisphere obeys and performs the orders and suggestions. Some authors, such as Jaensch (1923) and Werner (1948), have described that eidetic functions mediate true pictures of the gods. It is apparent that archaic humans actually saw and listened to Apollo, Zeus, Mary, or Jesus due to their eidetic organisation of psyche.

Ethnographic reports from all over the world have documented the same phenomenon. It is not only valid regarding the explanation of human actions but also regarding the explanation of unusual incidents across nature and reality. Pre-modern people throughout the world explain all "uncommon" phenomena, such as mishaps, disease, death, war, rainfall being too strong, quarrelling too hard, animals crying too loud, things lost, etc., as made by mystical forces such as divinities, sorcerers, witches, or whomever. A person dies from disease or from an animal attack, people immediately ponder which kind of mystical force caused the disease or the attack. Evans-Pritchard (1937) and Lévy-Bruhl (1923, 1971, 1985) described at length that pre-modern peoples interpret the whole world and the chain of occurrences as made by such mystical forces. Pre-modern peoples do not regard the world in terms of empirical-causal categories and in terms of causality, chance, and probability but in terms of magical and divine forces that rule the world to the smallest details (Oesterdiekhoff 1997, 2000, 2007a, b, 2009a, 2011, 2013b; Werner 1948; Piaget 1959; Zeininger 1929; Schultze 1900; Hallpike 1979).

Children's psychology explains these modes of thought. By their seventh year, children also have not elaborated the categories of chance, causality, and probability but explain the world in magical and animistic terms (Piaget 1932, 1959, 1969, 1975a, b;

Zeininger 1929, Werner 1948, Stern 1924; Wooley 1997). It has been shown for long that there is no difference between the worldview of children all over the world and that of pre-modern peoples (Schultze 1900; Werner 1948; Hallpike 1979; Oesterdiekhoff 2011, 2013a, 1997). It is obvious that the incapacity of children and pre-modern peoples to regard both the human psyche and physical incidents in terms of natural phenomena but in terms of mystical forces originates in certain brain functions. I believe that Jaynes' theory reveals a small part about these special cerebral structures. Not only the degree of lateralisation but all dimensions of brain development (in children) or arrested brain development (in pre-modern adults) account for this phenomenon. The role of the neocortex will also be relevant, as its development is decisive to coherent explanations, foresight, and planning (Eccles 1994).

Brain and moral development

Neocortex development is decisive to the development of morals, empathy, perspective-taking, and pity. This process is not complete before the age of 25 years in modern societies. The problems of moral behaviour and moral judgments among modern youth and adolescents mainly originate in this unfinished neocortex development (Swaab 2013; Eccles 1994). Cross-cultural psychology has shown that pre-modern humans usually do not surmount the anthropological levels of modern children aged ten years. Thus, the neocortex development of pre-modern humans would not attain the same level as among modern humans. Henceforth, their moral development cannot be expected to be able to reach the same level as typical to modern humans.

Lawrence Kohlberg discriminates six stages of moral development during ontogenesis. The first two stages are completed by the tenth year of life and the fifth and sixth stage unfold between adolescence and the 25th year of life in modern societies. The coherence between the accomplished development of neocortex and the emergence of the fifth and sixth stages is apparent, regardless of how strong this coherence may be. Only a quarter of modern humans reaches the fifth and sixth stages, while the others remain bound to the adolescent third and fourth stages. Cross-cultural psychology has determined that pre-modern peoples stay on the first and second stages, with only a very small percentage reaching the third stage. According to empirical studies, pre-modern peoples never reach the fourth, fifth and sixth stages (Turiel et al. 1978 and 1980; Hallpike 2004; Oesterdiekhoff 2009a). Henceforth, it is expectable that arrested neocortex development is linked to these features of moral development.

Developmental research confirms these coherences. According to the developmental approach, moral consciousness and the behaviour of humans goes from primitive to highly developed stages. Piaget (1932) was one of the first to deliver a significant contribution to the research into the moral development of humans. He described that initially children tend to attribute responsibility to other persons for all kinds of involvement and tend to overlook their motives and intentions. I have shown that this *objective responsibility* also characterises the law systems of pre-modern nations, due to the same psychological mechanisms. Pre-modern societies punish animals, plants,

objects, innocent persons, etc. to smooth the feelings of revenge, convincing themselves that they are obeying holy law. Blood revenge is necessary even then when the affected people did not want the offender killed, etc. They even accuse animals in front of courtyards, believing animals be persons with willpower, morals, and responsibility (Oesterdiekhoff 2009a, 2013b, 2002, 2009b, 2013a).

Piaget (1932) found out that younger children support severe punishments due to their lower intelligence. The punishment systems of every pre-modern society, regardless of race, culture, region, and continent, entail body humiliation, torture, and capital punishment. Historians of the law describe these punishment systems as "sadistic" and "barbarian". Lower psychological stages and lower neocortex development account to these phenomena. The growth of mental and brain functions, especially the rise of the adolescent stage of formal operations, has caused the humanisation of punishment law since 1700 in Europe and since 1900 overseas (Oesterdiekhoff 2009a, 2013b, 2002).

Of course, practices such as cannibalism, duel culture, slavery, cruel treatment of women and children are some of the manifold manifestations of the lower moral and neocortex (brain) development of pre-modern peoples. I want to exemplify the lower moral development of pre-modern societies with only one further but very clear example. In *The Descent of Man* (1872), Charles Darwin had said that the Roman arena games evidence the lower moral and psychological development of ancient people. The games consist of gladiatorial battles, the chasing and killing of wild animals, and the execution of criminals before audiences. These three elements, however, are found in every pre-modern culture as well as tribal societies and ancient civilisations. The first culture that abolished these elements was modern civilisation since the age of the Enlightenment. Therefore, the analysis of the morals and psychology of the Roman arena games also covers the morals and psychology of every pre-modern society, as Lafiteau (1724/1732) had mentioned when he compared the cruelty of the American natives to that of the ancient people in the arenas. The state elite and nobility enjoyed seeing such cruelties for entertainment over many centuries. If we heard now on the news or read in the newspapers that the British parliament or the American congress had decided to institutionalise a Roman game in a large arena where dwarves had to fight against naked girls or where criminals should be burnt as torches, then this information would be more incredible than the news about landing UFOS in the Hyde or Central Parks. Incidents such as these are truly impossible to consider. This fact evidences the lower moral and psychological development of ancient people and the increase of morals, sensitivity, empathy, pity, and intelligence over the past centuries. The emergence of the adolescent stage of formal operations and the increase of intelligence (Flynn effect) in recent generations account to this new stage of morals, sensibility, and empathy. The link to advancements of brain and neocortex functions is apparent (Oesterdiekhoff 2013b, 2011, 2009c).

Conclusion: brain, arrested development, and developmental window

The lower psychological development of pre-modern people refers to every form of behaviour, psyche, consciousness, and mind. *G* in intelligence research and *structures d'ensemble* in Piagetian psychology are the terms that express this world experience and the psyche encompassing and penetrating character of stages. Children are children regarding every aspect of psyche and personality. The same is true regarding the psyche of pre-modern (and modern) people. It is a strange phenomenon that adult humans raised in pre-modern societies do not surmount the levels of children aged 6, 8, 10, or 12, even not when they are 50 or 70 years old. Why do they not and why can they not attain higher anthropological levels later in life? Janet, Claparède, and Werner called this phenomenon the "arrested development of the primitives". I think brain research is helpful to illuminate this phenomenon.

I give an example to discuss this phenomenon. Everett (2008) shows that the Pirãha cannot learn to count 1, 2, 3, even after eight months of teaching. They have no idea of the existence of numbers, not even an intuitive idea. Most tribal societies, however, can count up to 5 or 10 when they use their fingers that both touch the objects with one hand and count on the other. Only the observation of three pieces does not suffice to count them. If they do not touch the objects, they fail. They must see, touch, and stretch fingers to know that there are three objects. This very common stage of counting in tribal societies reflects abilities of children aged three (Steinen 1894; Lévy-Bruhl 1921; Oesterdiekhoff 2013b; Luria & Vygotsky 1992; Werner 1948). The following stages of arithmetic in tribal societies and ontogenesis match to the necessity to reconstruct the history of mathematics in terms of developmental psychology. The question arises why many primitive peoples in world history did not learn to count only by watching or to calculate 3+2=5 or 3x3=9 by using their head? The answer that they did not need these capabilities is insufficient. People who count both by touching and by stretching fingers are making some effort; however, they are not able to attain higher stages relying on these kinds of efforts although they practise throughout their entire lives. Of course, if they had attended kindergarten and elementary schools early in their life they would learn it as modern children do.

Essentially, the large majority of pre-modern humankind did not learn to calculate 8-3=5 only by using their head. They did not attain the basic steps of understanding their minds and the world because they remained bound to very concrete forms of reason typical for preschool children. Decades of life experience changed nothing. These decades were not decades of increasing reflection and of growing consciousness. Arithmetic provides a very good example for the arrested stage development of pre-modern man. Moreover, the arrested stage development concerns all forms of logical, physical, social, and moral development of pre-modern man. Only very effective incentives, stimuli, and forces drive people to attain higher stages. Many years of school attendance are necessary to enable modern humans to attain the adolescent stage of formal operations. When new generations learn new stages, then they usually learn only a little more than the former generations.

Only seldom do new generations make greater jumps. The study of the development of law, religion, politics, philosophy, child rearing, gender relations, etc. show the stepwise and slow attainment of higher stages (Oesterdiekhoff 2013a, b, 2009a, 2011).

It is difficult to explain the arrested development and the slow development through social evolution when we only consider psychological phenomena and psychological theories. The additional and accompanying reliance on neurological phenomena sheds a deeper light on the hindrances and difficulties to attain higher stages. Of course, this does not mean that we should reduce the psychological studies on neurological ones or that the neurological phenomena are more real and valid in comparison to the psychological ones. The study of the neurological phenomena only allows a better understanding of the arrested stage development and the difficulties for humanity to climb on higher stages.

The facts concerning the psychological development of the humankind from childhood to adulthood are mostly unfamiliar to contemporary scientists of every discipline. The main target of this article is to inform brain researchers about these facts. They should research these facts. My theory provides a context in which they can perform their empirical studies.

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Povzetek

Raziskovalci možganov bi morali študirati piagetovsko medkulturno psihologijo, drugo vejo medkulturne psihologije, ki temelji na psihometričnih raziskavah inteligentnosti. Glede na empirične podatke, zbrane v več kot tisoč izvedenih študij po vsem svetu, pripadniki predmodernih skupnosti ne dosegajo stopnjo formalnih operacij mladostnikov, ki je značilna za pripadnike modernih skupnosti. Različni razvojni pogoji zadevajo celotno paleto razvoja osebnosti v logičnih, telesnih, družbenih in moralnih dimenzijah. Predstavljeni podatki o različnem psihološkem razvoju predmodernih in modernih ljudi so pomembni za razumevanje zgodovine kulture, družbe, religije, filozofije, morale, prava in politike. Obstajati morajo povezave med temi različnimi razvojnimi potmi ter ustreznimi možganskimi strukturami, ki upravljajo različne stopnje psihološkega razvoja. Ta knjiga predstavlja tovrstne medsebojne odnose do skrajnih področij znanega, kakršna so razvoj neokorteksa, možganska lateralizacija ter gostota in število živčnih celic in sinaps. Raziskave možganov lahko pomembno prispevajo k razlagi zaustavljenega razvoja predmodernih populacij in počasnega psihološkega napredka med več fazami družbene evolucije. Nova teorija ponuja nove usmeritve za mednarodne raziskave možganov, ki se osredotoča na vlogo siromašenja in bogatenja okolja za ontogenetski razvoj možganov. Medtem, ko je ta teorija znatno poglobila okoljsko teorijo razvoja možganov, pa je zasenčila tiste pristope, ki poudarjajo stalno in nespremenjeno stanje možganov od pleistocena naprej.

KLJUČNE BESEDE: razvojna psihologija, psihološke faze, možgani lateralizacija, neokorteks, socialna evolucija, predmoderna družba

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