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CHAPTER 1
REVIEW OF THE LATEST CONCEPTS CONCERNING COGNITIVE AND EXECUTIVE FUNCTIONING

ABSTRACT
According to the concept of Lezak and associates (2004) cognitive functioning is one of the three aspects creating human behavior. The aim of this work is to summarise the latest research and analyses relating to cognitive and executive functions including data from neuroimaging. Cognitive functions were divided into five categories: receptive functions, memory and learning, thinking, expressive functions and cognitive activity variables. Furthermore, executive functions were characterized. The most attention was drawn to memory processes. The division proposed seems to apply not only to scientific elaboration, but also to clinical practice.

INTRODUCTION

Researchers of different scientific disciplines have been interested in the effectiveness of cognitive functioning for many years. The knowledge on the human's coginitve resources and their limitations is closely connected with the functioning of the central nervous system. The brain coordinates and integrates information from external and internal environment into significant unity and evokes proper body response (Herzyk, 2005). Since the 90s of XX century (so called „brain decade") there have been many scientific research works made aiming to enable understanding of complicated processes taking place in a human brain (Martin, 2001). The results of the carried out so far studies provide

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useful information, nevertheless they not only do not answer all the questions posed but they arise new ones. Undoubtedly, successes of neuroscience have contributed to improving knowledge on human behavior, in cognitive aspect in particular. It is worth mentioning here that human behavior can be investigated in the categories of three functional systems. Already mentioned cognitive aspect is responsible for acquisition and processing of information, emotionality – concerns emotions and motivation and executive functions – responsible for the way in which behavior is expressed (Lezak, Howieson and Loring, 2004). All the three components are an integral part of any behavior, although they can be investigated and treated separately (Lezak et al., 2004).

Due to neurobiological conditioning of cognitive functioning the aim of the work is to summarise the latest research and analyses relating to cognitive and executive functions in neuroscience context.

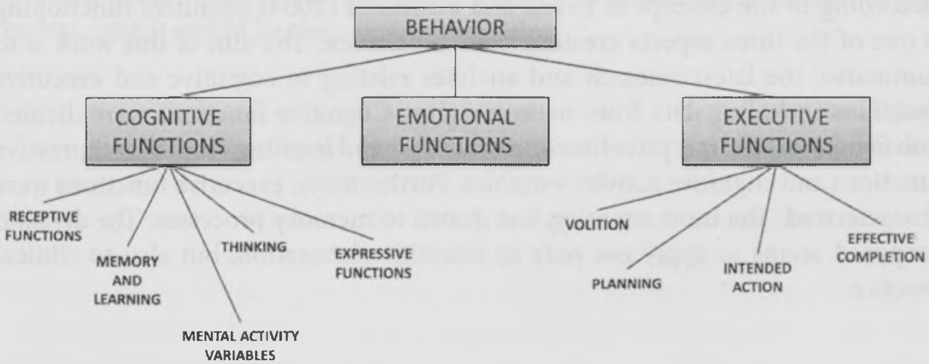

Fig. 1. Three aspects of human behavior with particular reference to cognitive and executive functions. Own elaboration based on: Lezak et al., 2004.

The term cognitive functioning is commonly used, unfortunately it has not been yet precisely defined. Many trials have been made to create a brain functioning model, which would describe the structure of cognitive system and the rules of information processing (Herzyk, 2005). Depending on the type of empirical data used there have arisen among others: neuroanatomic models, systemic models (e.g. the concept of Luria's dynamic functional systems), neurocognitive model (computer metaphor of the brain, neuronal network models), cognitive (computation hypothesis) and evolutionary (microgenetic concept) (Herzyk, 2005, Pąchalska, 2009). Lezak and associates (2004) referring to computer metaphor, categorise cognitive functions into four basic groups: 1) receptive functions – reponsible for choosing, acquiring, recognition and integration of information, 2) memory and learning – relates to acquiring, storing and recalling information, 3) thinking –responsible for mental organisation and reorganization of information, 4) expressive functions – enabling to convey information. In each group more detailed functions can be distinguished, e.g. recognition of colours, direct memory of spoken words (Lezak et al., 2004). Particular cognitive functions tightly cooperate with each other and are inseperably connected creating various aspects of the same activity (Lezak et al., 2004). What is more, cognitive functions also comprise mental activity variables, to which consciousness is assigned, attention functions and activity rate (Lezak et al., 2004).

RECEPTIVE FUNCTIONS (PERCEPTION, ATTENTION)

Perception is the process of active interpretation of data from sense organs with the use of context cues, an attitude and eariler acquired knowledge (Nęcka, 2006). Its effect is the identification of an object (person, place, item) or an event (situation or state) (Nęcka, 2006, Pąchalska, 2007). Perception relates to identification and interpretation of received sensory sensations (Levin and Schefner, 1981, Pąchalska, 2009). In natural environment perception is a complex process and thanks to the possibility of intermodal integration many cooperating with each other functional systems, among others: perceptive, motor, cognitive and emotional are incorporated in its functioning (Lezak et al., 2004, Herzyk, 2005). The specificity of the structure and functions of particular neuronal systems enable discrimination of at least three phases of transformation of acquired stimuli: sensory reception, perception and interpretation. Detection and registration of the sensoric characteristics of a stimulus (sensory reception) takes place in highly specialised cells – receptors. Initial identification of a stimulus and distinguishing its important traits takes place in the process of categorisation (perception), after which stimulus recognition, giving it its meaning (interpretation), as well as the choice of body response proceed (Herzyk, 2005).

Dysfunctions appearing in various phases of data processing elicit specific distractions. Disorders in the perception of sensoric qualities of stimuli, e.g. amblyopia, central deafnesss, are treated as disorders in physiological sight and hearing parameters. In the case when the sensoric traits of a stimulus are recognised properly but the process of data categorisation is disturbed, perception disturbances occur, such as agnosias. Whereas faulty interpretation of observations leads to formulation of inadequate to the reality judgements, gradings and delusions, anosognosia (Lezak et al., 2004, Herzyk, 2005).

MEMORY AND LEARNING

Memory constitutes one of the most important adaptive factors, since it enables solidifying (encoding) and storing of experiences from the past, learning new ones and using it at present and in the future (Tulving and Donaldson, 1972, Herzyk, 2005). Memory system is the way in which the brain processes information, which will be available to use later (Schacter and Tulving, 1994, Budson and Price, 2005). At present, complex and multidimensional structure of memory is emphasised, which is reflected in appearence of various clasifications made on the basis of different division criteria, e.g. information storage time, the type of information, the way of encoding, extracting and recollection of information (Budson and Price, 2005, Herzyk, 2005, Rajewska-Rager and Rybakowski, 2006, Jagodzińska, 2008).

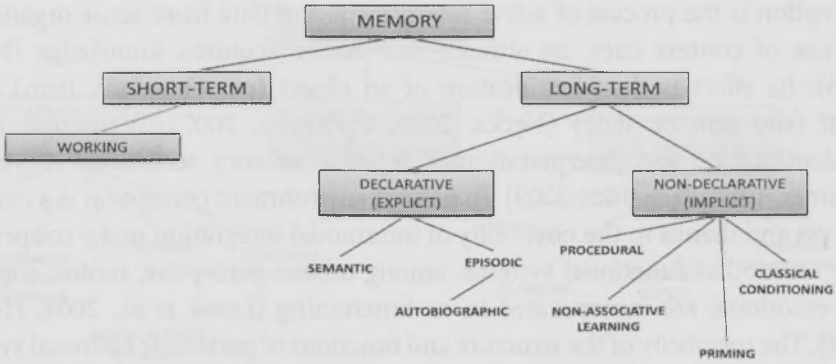

Fig. 2. Memory division. Own elaboration based on Squire, 1992, 2004, Baddeley, 2004, Lezak et al., 2004, Rajewska-Rager and Rybakowski, 2006, Maruszewski, 2010.

Particular types of memory are involved in different neuroanatomic structures (Budson and Price, 2005). A collation of the most important neuroanatomic structures involved in various memory systems – table 1.

Three stages of each memory system can be distinguished: encoding, during which information is registered; storage, thanks to which information is temporarily stored; recognition, recall and reconstruction (Baddaley, 2004, Jagodzińska, 2008).

Learning is the process initiating constant changes in behavior, which are the effects of experience (Longstaff, 2006, Jagodzińska, 2008). The essence of learning is the plasticity of the nervous system, consisting in the ability to

Tab. 1. The collation of the most important neuroanatomic structures involved in various memory systems.

Memory system	Main neuroanatomic structures
Episodic	▸ medial temporal lobes ▸ prefrontal cortex ▸ subcortical structures: – hippocampus – fornix – anterior thalamic nuclei – mamillary body
Semantic	▸ inferior lateral temporal lobes ▸ various areas of cortex, e.g. prefrontal cortex
Procedural	▸ basal ganglia ▸ cerebellum ▸ supplementary motor area ▸ parietal lobes ▸ occipital lobes
Working	▸ dorso-lateral prefrontal cortex ▸ different areas of cortex, e.g. central part of parietal cortex, Broca's area, Wernicke's area ▸ subcortical structures: – hippocampus – thalamus ▸ cerebellum

Own elaboration based on Budson and Price, 2005, Borkowska et al., 2006, Borkowska, 2006, Maruszewski, 2010.

rebuild nervous conjunctions (Longstaff, 2006). Acquired changes in behavior (engrams) are stored in the nervous system (Lezak et al., 2004, Longstaff, 2006).

Due to information storage time short-term memory (STM) and long-term memory (LTM) are distinguished (Borkowska, 2010). Short-term memory is characterized by a scant capacity (7±2 elements according to Miller or 4±1 according to Cowan) and relatively short-term storage of information (a few up to over a dozen seconds) and long-term memory – large capacity and long-term information storage (Kowalska, Kuśmierek, 2006, Jagodzińska, 2008). In past few years attention was drawn to a particular type of short-term memory – working memory (Baddaley, 1986, 2002, Herzyk, 2005, Borkowska et al., 2006).

Working memory enables storage of information in short-term memory and manipulating it depending on current requirements (Baddaley, 1986, 1998, Borkowska et al., 2006). It is responsible for temporary storage of information about currently being conducted activities and for the ability to switch to new principles of action (Borkowska et al., 2006). Working memory is a complex system, in which independent from sensory modality, central executive system, coordinates subsystems responsible for the processing of information of various modality (phonetic and spatial) (Baddeley, 1998, Budson and Price, 2005). Depending on the action taken the network of subcortical and cortical conjunctions (dorso-lateral prefrontal cortex, other parietal and prefrontal areas) is started, and the number of activated brain's areas is rising together with the increase in complexity of the processed information (D'Esposito and Postle, 2000, Jaeggi, Seewer and Nirkko, 2003). Due to the involvement of numerous neuroanatomic structures in the functioning of working memory each injury, brain tumor or other disease process can cause disturbance in its functioning (Rajewska-Rager and Rybakowski, 2006).

The dysfunctions of working memory were noticed among others in: affective diseases, schizophrenia, ADHD, obsessive-compulsive disorder or neurodegenerative diseases (Baxter and Liddle, 1998, Purcel et al., 1998, Martinez-Aran, Vieta and Colom, 2000, Borkowska and Rybakowski, 2001, Calderon et al., 2001, Klingberg, Forssberf and Westerberg, 2002, Borkowska, 2003, Egeland, Sundet and Rund, 2003, Lewandowska and Rybakowski, 2009).

Long-term memory enables permanent storage of information (Cowan, 2008). One of the most known divisions distinguishes two memory systems: declarative and non-declarative (Squire, 1992, 2004, Baddeley, 2004).

Declarative (explicit) memory relates to the ability to consciously recall facts and events (Squire, 2004). There can be two types of memory distinguished: semantic (facts, information about the world not related to the individual's experience and memories) and episodic (affectively saturated events in a particular time-space context) (Tulving, 1983, Squire, 2004, Maruszewski, 2010). Study results indicate that the mechanisms of encoding and storing of semantic and episodic data are different (Linton, 1982). What is more, the engagement of various brain areas during using semantic and episodic memory was demonstrated (Tulving, 2002, Maruszewski, 2010). Left prefrontal cortex agitation was noticed during encoding of information in episodic memory and recalling information from semantic memory, while the activation of right prefrontal cortex was detected during encoding of information in semantic memory and while recalling information from episodic memory. These relations concern verbal as well as non-verbal material (Tulving, 2002, Maruszewski, 2010). In episodic memory autobiographic memory, which constitutes the storage of past personal experience and plays a role in the regulation of current behavior, is taken into account (Niedźwieńska, 2008, Maruszewski, 2010). Centers relating to the memory of emotions (amygdaloid nucleus) prefrontal cortex and hippocampus are engaged in autobiographic memory (Borkowska, 2006).

Non-declarative memory (implicit) relates to the abilities to learn traits, which are not declarative (Squire, 1992). It comprises the memory of abilities, habits and procedures (procedural memory), it takes part in priming, simple classical conditioning and nonassociative learning (Squire, 1992, 2004). Procedural memory is the ability to learn simple and complex sensory, motor, cognitive, emotional and social activities (Jagodzińska, 2008).

Acquiring skills can be conscious or implicit, e.g. when driving a car – the initial stage of learning is conscious, later the activity is subjected to automatization (Budson and Price, 2005, 2007, Jagodzińska, 2008). Basal ganglia, cerebellum, parietal occipital and pre-motor lobes are mainly engaged in procedural memory functioning (Budson and Price, 2005, 2007, Borkowska, 2006). Disturbances of procedural memory can appear as a result of injury or dysfunction in basal ganglia and/or cerebellum, among others in people with Parkinson's disease and Huntington's disease, obsessive-compulsive disturbances and in those with depression (Heindel et al., 1989, Sabe et al., 1995, Roth et al., 2004).

Other memory area is prospective memory (PM) (Maruszewski, 2010). It relates to formulation and storage of plans and promises, which are to be recalled in a proper time and after the appearance of specific clues in the future (Graf, 2012). PM differs in the same respect from retrospective memory (RM), which relates to recalling information remembered in the past (Herrmann et al., 1999, McDaniel and Einstein, 2000, McCauley and Levine, 2004, McCauley et al., 2009). It is underlined that PM plays an essential role in everyday functioning (McCauley and Levine, 2004, McCauley et al., 2009, Kondo et al., 2010). In prospective memory event-based tasks (E-B) and time-based tasks (T-B) can be distinguished. E-B relates to remembering of the intention to conduct the activity in response to a specific event, e.g. providing a particular person with a piece of news. T-B refers to the intention to conduct a specific task in a definite time or after some time, e.g. taking medicine at 6 o'clock in the morning (Einstein and McDaniel, 1990, 1996, McCauley et al., 2009). Some researchers enumerate also activity-based PM (A-B), which refers to the intention to conduct a specific activity in the break between other tasks, and the exact time is not known (Kvavilashvili and Ellis, 1996, McCauley and Levine, 2004). Similarly as in retrospective memory, in PM there can be distinguished: monitoring, episodic prospective memory and habitual prospective memory (Kvavilashvili and Ellis, 1996, Graf and Uttl, 2001, Graf, 2012).

PM is a complex process consisting of at least four stages. In the first one the intention to conduct a particular activity is planned and encoded. In the second stage information is stored and the environment is monitored in order to detect potential tips initiating its use during accomplishment of other activities.

In the third stage, after recognizing specific tips (time, event) recollection of the intention to conduct the activity takes place. In the last one, fourth stage, currently being conducted activities are stopped in order to carry out the intended activity (Burgess et al., 2000, Kliegel et al., 2004, McDaniel and Einstein, 2007).

The results of neuroimaging and neurophysiological examination show engagement of frontal system and hippocampal system in PM (Okuda et al., 1998, Burgess et al., 2001, Burgess et al., 2003, Simons et al., 2006, Okuda et al., 2007, Reynolds et al., 2009). Deficits of PM were recognized also after the damage of left parahippocampal gyrus, left interior parietal lobe and/or left anterior cingulated (Kondo et al., 2010).

THINKING

Thinking relates to mental operations carried out on explicit (e.g. mathematical calculations) or non-explicit (e.g. moral assessment) information (Lezak et al., 2004). Among mental operations the following are listed: computation, reasoning and judgement, concept formation, abstracting and generalization, ordering, organizing, planning and problem solving (Lezak et al., 2004). The category of thinking can be defined on the basis of the type of the activity being performed (e.g. comparing, computation, abstracting) and the properties of the information being processed (e.g. numbers, views, words), e.g. the term „verbal reasoning" comprises information about a few operations carried out on words, among others: ordering, comparison and sometimes analyzing as well as synthesizing (Lezak et al., 2004). Unlike other cognitive functions at the bottom of neuroanatomic thinking one cannot distinguish specific brain structures – it is underlined that the whole brain is engaged in thinking process (Lezak et al., 2004). The exception is arithmetic activity, in which case the relation between particular processes and agitation of brain structures was demonstrated (Lezak et al., 2004).

Thinking can be disturbed after appearance of diffuse brain injury and after the injury of functionally separate brain areas of the lower stages of hierarchy. Thinking can also stay relatively stable in specific injuries of the remaining cognitive functions (Lezak et al., 2004).

EXPRESSIVE FUNCTIONS

Expressive functions enable passing information and creating observable behavior. On their basis mental activity can be deduced. This includes speaking, drawing, writing, manipulating, gestures and facial expression (Lezak et al., 2004).

Referring to brain organization at least four levels of motor activity are distinguished: 1) innate reflexes, e.g. spinal; 2) innate motor habits, e.g. escape reaction, and acquired reflexes of various complexity, e.g. walking, writing, drawing, in which cerebellum, basal ganglia and their descending connections to brain stem, spinal cord and muscles are engaged 3) unintentional moves; 4) complex motor activity. Unintentional moves are meaningful for consciously controlled, direct explorative and cognitive activity of the environment, e.g. manipulating with objects. They are carried out according to the earlier experience and may undergo modifications depending on environmental conditions. Areas of motor and sensorimotor cortex are engaged in their functioning. Complex motor activity, within which long-term plans of activity, aims in life (e.g. professional development) are carried out and prediction of the decisions made takes place, constitutes an integral part of executive functions. In its functioning lateral and medial areas of frontal lobes, in which integration processes and assessment of information as well as initiating of proper forms of activities take place (thanks to numerous connections with remaining areas of cortex and subcortical structures), are engaged. A proper conduct of motor activities depends on cooperation of brain systems responsible for specific stages of motor functions. Desorganization of cortical systems of motor regulation leads to appearance of disturbances of apraxia type (Herzyk, 2005).

Verbal processes enable communications among people. They play a role in the process of shaping thinking and the system of terms and they are an inseparable element of learning. Furthermore, language is indispensible in expressing and describing emotional states and constitutes an important factor in the process of social absorption (Borkowska, 2010). Efficient course of verbal processes depends on the abilities to receive verbal signals and understand speech, to use verbal expression, as well as on the fluency of speaking and verbal memory. The role of sound aspect of speaking – prosody – is emphasized (Borkowska, 2010). In language communications language competencies (vocabulary, the knowledge of grammar rules, the ability to create texts) and grammar competences (knowledge and abilities concerning adequate rules of language forms usage) are significant (Herzyk, 2005). That shows the essential role of the left hemisphere in the regulation of these processes. Particular brain areas control specific language functions: expression, understanding, naming, repeating and reading (Szeląg, 2006). Furthermore, the role of the right hemisphere in language information processing is emphasized, particularly in the regulation of relations between language and pragmatic competencies (Herzyk, 2005).

MENTAL ACTIVITY VARIABLES

Mental activity variables are indispensible in effective functioning of cognitive functions. They comprise consciousness, attention and activity index (Lezak et al., 2004).

Consciousness relates to the readiness of the body to receive stimuli and the state of being vigilant (presence of mind) (Lezak et al., 2004). This term is used also to define the state, in which a person realizes that he or she is conscious (awareness) (Lezak, 2004, Pąchalska, 2007, 2009). The strength of relations taking place between the components of consciousness (e.g. the state of being vigilant, perception, self-consciousness, concentration and reflection) conditions the quality of the experience (Brown, 2000, Pąchalska, 2009). Consciousness is connected mainly with the brain cortex activity, although the meaning of the whole brain, e.g. brain stem, midbrain, thalamus, is emphasized (Pąchalska, 2009). The level of consciousness ranges from full consciousness, through drowsiness, somnolence and stupor, to coma (Lezak et al., 2004). Even insignificant reduction in consciousness may lead to diminished cognitive capacity causing fatiguability, lack of attention or slowing down. The level of consciousness can differ, among others depending on physiological metabolic changes, changes in daily cycle, level of fatigue (Lezak et al., 2004). Disturbances in consciousness can accompany functional disturbances or pathological states of the brain (Lezak et al., 2004).

Activity rate relates to the speed of conduction of cognitive activities and the speed of motor response (Lezak et al., 2004). The slowing-down behavior occurs in the elderly people as well as in those after brain injury (Lezak et al., 2004). Motor response slowing can be connected with weakness, poor condition or injury of the assessed limb. Mental activity slowing down can be deduced on the basis of the lack of mental capacity, e.g. lowered hearing range together with diminished accuracy of the task completed and poor concentration, although each of the symptoms mentioned can have other cause (Lezak et al., 2004). It appears that the slowing down of processing speed causes benign memory lapses appearing in the elderly people (Lezak et al., 2004).

Attention is the mechanism, which is responsible for the reduction of information overload (Nęcka, 2000) in order to prevent negative consequences of cognitive system overload (Nęcka, 2006). It functions at all stages of information processing, starting with acquiring sensations, encoding, recalling engrams, through mental processes, to the choice of initiated reaction (Wciórka, 2002). Attention processes can be initiated automatically – through stimuli important for survival, e.g. a sudden boom, or conscious – through stimuli, which are interesting or important in respect to the aim determined (Lezak et al., 2004, Pąchalska, 2007). The stimuli important for survival arouse the lowest part of the nervous system – brain stem and midbrain, the stimuli perceived as interesting arouse the limbic system and the stimuli important in respect to the aim determined initiate brain cortex, particularly prefrontal lobes and structures related to memory, mainly working and prospective one (Pąchalska, 2007). Attention is a complex process, subjected to the processes of being vigilant, arouse and conscious (Pąchalska, 2007). In its functioning initiation mechanisms, orientation activity of sense organs, motivation and memory processes are incorporated (Posner and Petersen, 1990, Pąchalska, 2007). It is tightly connected to intelligence, emotions and attitude (Pąchalska, 2007). It is emphasized that the attention system capacity is limited (Lezak et al., 2004). It was shown that the capacity of attention system differs not only among individuals but it depends on the time and conditions, in which he or she is in, e.g. temporary reduction in attention capacity was found in the elderly people, tired and depressed ones (Lezak, 2004). Four main aspects of attention can be distinguished: 1) focused of selective attention – it is the ability to highlight essential information with suppression of disturbing stimuli at the same time; 2) sustained attention or vigilance – refers to the ability to sustain attention for some time; 3) attention divisibility – possibility to reply more than one task or element in an operation or a task, e.g. mental. It is very susceptible to factors diminishing the capacity of attention; 4) alternating attention – enables the change of attention and spotlight (Lezak et al., 2004).

It was ascertained that even a small injury, comprising a part of the attention system, can cause changes in activity in more than one aspect of attention (Lezak et al., 2004). At the bottom of attention disturbances there is a slowing-down of processing, which can have a significant impact on the functioning of attention (Lezak et al., 2004). Attention and concentration deficits are often a common problem relating to a brain injury (Lezak et al., 2004). Study results show the occurrence of impaired concentration, lowered attention divisibility and increase in the level of distraction after injury of prefrontal lobes, particularly the left dorso-lateral prefrontal cortex and caudate nucleus (Brazzeli et al., 1994, Godefroy et al., 1994, Godefroy and Rousseaux, 1996). In persons with attention deficits diminution of the cognitive systems capacity caused by inattention, incorrect concentration and resulting tiredness are observed (Lezak et al., 2004).

EXECUTIVE FUNCTIONS

Executive functions define abilities, which play a role of internal regulators of behavior (Herzyk, 2005), and they are responsible for formulation of aims, planning and controlling of the way of their achievement (Lezak, 1982, 1987). They are indispensible and integral factor of other functions: cognitive, emotional, motor; they enable independent, creative and socialized behavior (Herzyk, 2005, Lezak, 1995). Lezak and associates (2004) underline that executive functions differ from cognitive functions. Executive functions relate to activities answering questions „how", „if ", e.g. "Will you do it? If yes, than how and when?", while cognitive functions refer to questions „what" and „how much", e.g. "What can you do? How much do you know?" (Lezak et al., 2004). Cognitive functions disturbances are usually limited to a certain function or a functional area, while executive functions disturbances manifest in all aspects of behavior (Lezak et al., 2004). Cognitive and executive spheres of a given activity are closely connected. Behavior is disturbed through a defect in control even when cognitive potential is correct (Lezak et al., 2004, Jodzio, 2008). Furthermore, executive dysfunctions can directly affect cognitive functioning (Lezak et al., 2004).

Many concepts treat cognitive functions as the processes of control (Ackermann et al., 2010), among others: executive control (Schwartz et al., 1991; Borkowska, 1999; Duncan and Owen, 2000; Goldberg, 2001), supervisory control (Shalice, 1998), mental control (Lezak, 1995; Walsh, 2001; Cummings and Mega, 2005).

Lezak (1995) distinguishes four aspects of executive functions: 1) volition, which is a complicated process defining unique individual's needs and desires and targeting the individual to satisfy them in the future; 2) purposive action – lies at the boom of an intentional action. It is a proper mental attitude comprising the intention and readiness to initiate action in order to achieve the intended effect; 3) planning – aiming to formulate stages of the aim achievement through conceptualization of expected and awaited changes, description of surrounding phenomenon in an abstract way, perceiving alternative solutions and choosing the right ones; 4) effective performance. Some researchers enumerate other processes formulating executive functions: anticipation, objective choice of the aims, planning, the choice of behavior, auto-regulation, auto-control and using feedback in these processes (Sholberg and Mateer, 1989, Ackermann et al., 2010).

Disturbances of executive functions are connected with prefrontal cortex injury (Herzyk, 2005). Basic functions of knowledge management system are disturbed (e.g. initiating, modulation of activity, anticipation capacity, ability to self-analyze, self-control, possibility to monitor activity and correct mistakes), although the knowledge itself is preserved (Lezak et al., 2004, Herzyk, 2005).

SUMMARY

In the article the trial to summarize already gathered studies and analyses concerning cognitive functions including neuroanatomic data was conducted. From the available models of cognitive functioning the most clear, in the authors' opinion, seemed to be the model proposed by Lezak and associates (2004). Despite of recalling already questioned metaphor of mind as a computer, division of cognitive functioning into five aspects (receptive functions, memory, learning, thinking, expressive functions and variables of cognitive activity) and distinction of executive functioning seem to apply not only in scientific elaborations, but also in clinical practice.

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