One of the secrets which has not been fully unravelled yet is the question how the cooperation of relatively simple elements more complicated cognitive functions can work? Why are we able to instinctively change gears in a car, listen to the radio and stop at the red light at the same time? Why are we able to drive a car in the night despite thousands of shining billboards? We owe all this to the mechanism of cognitive control which is the ability of our cognitive system to supervise and regulate our own cognitive processes and also to plan how they should operate (Nęcka, Orzechowski & Szymura, 2007). Without this it is impossible to fully explain how the human mind functions. However, what are the reasons for such control? Is there anything that supervises this control? In science this problem is known as the homunculus problem – a small creature in our mind that controls it. Therefore, modern scientists try to get rid of him while looking for an explanation of how the cognitive control functions. That is why the research being carried out on the cognitive control concerns two directions. One of them is connected with the answer to what is the form of the cognitive control system. On this basis, one of the most modern approaches to the issue of cognitive control is the theory of Dual Mechanisms of Control (Braver, Gray & Burgess, 2007; Braver, 2012). The other one is connected with looking for factors that can modify its functioning. In this scope, particular attention is paid to such factors as affect, a task's difficulty, working memory and motivation (Banich et al., 2009; Chiew & Braver, 2011; Goschke & Bolte, 2014).

The research project being suggested concerns the second direction connected with looking for factors that can modify cognitive control. Special attention is paid to the affect, the difficulty of tasks being performed and the working memory capacity as factors that can influence the cognitive control. The affect is understood as an emotional state connected with a particular object or situation, with a determined valence (positive-negative) which can cause both low and high arousal (Kolańczyk, 2004). Moreover, we can distinguish a third component of the affect which is the approach-motivation intensity connected with the intensity of the desire to reach a given object (Gable & Harmon-Jones, 2010; Harmon-Jones & Price, Gable, 2012) or the avoidance-motivation intensity which means avoiding a given object (Braver et al., 2014). The working memory capacity is the reflection of general differences in terms of controlling attention which is needed to perform a number of cognitive tasks (Engle & Kane, 2004; Kane, Conway, Hambrick, & Engle, 2007). The theoretical framework of this project is the concept of Dual Mechanism of Control (DMC) which highlights two different modes of the cognitive control's functioning: proactive and reactive. The first one is connected with context and goals according to which the cognitive system modifies its functioning. The second one is connected with the reaction to already existing conflicts or interferences (Banich, 2009; Braver, 2012). For example, if a driver, arriving at a crossroads has read an information saying that lights are broken he or she can adjust manoeuvres on the road to this change (proactive control). However, if the driver has not read it or has not taken it into consideration he or she will start doing manoeuvres when being already at the crossroad to avoid collision with other cars. Therefore, the overarching goal of the project is to verify basic hypotheses, fill in important gaps in current knowledge in the field of cognitive control and formulate new research questions that will allow for further development of this field of research. They are focused on acquiring new knowledge of the basic of phenomena and observable facts, without focusing on any direct practical application.

In order to respond to questions, two experiments have been designed. The first one, based on behavioural indicators, aimed at testing hypotheses concerning the mutual influence of affect, the level of difficulty of the task and working memory performance on cognitive control. The second one, based on electrophysiological indicators, aimed at testing hypotheses regarding the impact of affect differing by its two components (level of arousal and motivational component), on cognitive control. Both experimental studies are based on the paradigm of the Continuous Performance Test - AX-CPT. It is a task that primarily involves the ability to update the incoming information (Goschke & Bolte, 2014). It is a paradigm in which letters are displayed sequentially to a subject. One of them is a cue and the second is a probe. There are four possible sequences: (1) AX: letter A, followed by X; (2) AY: first letter A, followed by any letters besides X; (3) BX: any letter besides A, followed by X; (4) BY: first, any letter besides A, followed by any letter besides X. The participant has the task to react in a specific way (e.g., to press the left mouse button) on the probe appearing in the sequence AX. However, in the case of other sequences, the participant has the task to react in a different way (e.g., to press the right mouse button). This task is an extended version of the paradigm of go/no-go tasks which take into account the context in the form of a specific cue, after which the participant must respond to the probe — being the goal. In this task, it is possible to observe whether a participant uses more context information associated with committing more errors in the sequence AY, or the reactive mode of activity associated with more errors in the sequences BX. If a participant has more errors in the sequence AY and fewer in BX, it reveals more proactive control. However, if the participant has more errors in the sequence BX and fewer in AY, it reveals more reactive control or proactive control reduction (Braver & Cohen, 2001; Braver et al., 2007).

In the first experiment, experimental manipulation will affect the level of difficulty of the task and affect. Participants of the examination (N = 300; 150 low working memory capacity; 150 high working memory capacity) will be randomly assigned to five subgroups, where affective material will be presented: neutral valence, positive with low level of arousal and positive with a high level of arousal, negative with low arousal level and negative with high level of arousal. Then, people from each of the subgroups will be presented with a task consisting in easy and difficult samples presented in a random order. The task of the participants will be to respond to the letter sequence in which one is an cue and the second one is a probe, depending on the emerging four possible configurations. The subject of analysis includes behavioural data, namely synthetic Proactive index (Chiew, Braver, 2014) calculated separately for response times and the number of errors. During the research the following equipment will be used: desktop PC with 17"monitor with a resolution of 1024 × 768 and a QWERTY keyboard, through which people will react to on-screen stimuli.

In the second experiment, each participants (N = 25) will have a task consisting in 8 blocks. In each block, affective material will be presented, selected according to the level of arousal, the type of the motivational component (approach-motivation intensity vs avoidance-motivation intensity) and the intensity of that component. The task of the people, as in the first experiment, will be to respond to the letter sequence in which one is an indication and the second one is target stimulus. These sequences may appear in the four possible configurations. The subject of the analysis includes electrophysiological data, namely amplitude of CNV component (proactive control indicator) and the amplitude of the N2 component (reactive control indicator). The EEG component is the average electric potential recorded from the head in brain's response to emerging stimuli. It has its own amplitude (positive or negative) and latency (time needed for a stimulus to emerge). During the research the following equipment will be used: integrated and modified system for recording and analysing Geodesic EEG 300 of Electrical Geodesic, Inc. Company, which includes. The Dell 17 Display" with a resolution of 1024×768 for presenting visual stimuli and E-Prime 2.0 software.

The issue related to the factors modifying cognitive control is critical for modern science. It includes the search for factors explaining perception and action of every person. Therefore, it is an inspiration to a deeper and comprehensive understanding of the functioning of the cognitive system of each of us. In addition, previous studies provide equivocal conclusions about the factors modifying cognitive control. This is an interesting and important issue that must be resolved. This project is focused on the affect, difficulty of the task and working memory performance, as the factors which could modify cognitive control. If the presumptions that affect impacts in a different way on cognitive control depending on the level of arousal caused and / or motivational component are confirmed, it will be empirical support the hypothesis proclaiming altering influence of affect on cognitive control.