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Chapter 16

TRAINING INTERACTIVE PSYCHO-STIMULATOR FOR THE POLICE

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ABSTRACT
In December 2012, the Police Academy in Szczytno started a research project entitled "Development of a training interactive psycho-stimulator for the Police". Its purpose is to develop and implement an innovative diagnostic and training system to evaluate and stimulate the cognitive competencies and psychomotor skills of police officers. Cognitive assessment of competence is essential to the operation of both police officers and other uniformed services (including officers of the Military Police). The diagnostic-training system implemented under the project will allow automated assessment of the current efficiency level of cognitive and psychomotor functions, and then it will be possible to offer various forms of exercise for these functions in the form of games that will be implemented on both desktop computers and mobile devices such as smart phones or tablets. The key tasks of the project should include the development of: a set of psychological tests to monitor the efficiency of the cognitive processes (i.e. memory, perception, concentration and divisibility of attention, the ability of inference); game set – exercises that stimulate the development of selected cognitive processes; a psychophysiological recorder to aid training; a set of psychological tests to assess the state of cognitive and psychomotor efficiency. The essential innovation is the introduction of ongoing research systems used to stimulate the cognitive competencies of police officers by designing exercises in the form of computer games and to enable the verification of the current mental condition of policemen before assigning tasks requiring special predisposition. Implementation of the solution developed, by developing the personal skills of police officers, will have a positive impact on the operational readiness of the officers, which will be translated directly into the security of the state (Suchodolski, 2002; Lachowicz, 1995). At the same time, widening the field of application to other entities, it may contribute to the increase of the efficiency and safety, particularly in occupational groups performing work requiring specific cognitive predispositions and psychomotor skills.

Keywords: psycho-stimulator, cognitive psychology, psychophysiology, polygraph.

1. INTRODUCTION

Ensuring public order is one of the key issues for the state in respect of the security of its citizens. This task is performed by a number of entities, which, in their essence, focus on simultaneously supervising compliance with the law in the life of society, in many areas of activity. The parties responsible for protecting the safety of people and property, for the maintenance of public order, for the prevention of offenses against threats to human health and life are the uniformed services. The officers of these services – especially Police officers, but also Military Police officers – often face difficult tasks.

2. THEORETICAL RATIONALE. THE CONCEPT OF THE RESEARCH PROJECT

Many factors have an influence on the effectiveness of their actions; however, the cognitive competences are the most crucial. In response to the new challenges posed by constantly changing dynamic situations, there is a need to develop the necessary cognitive functions in the work of police officers that have fundamental meaning to the proper functioning of their duties. The efficiency of most organizations is determined by all subsystems and relationships, but human resources seem to be the key issue and that is why it is so important to properly select officers to perform tasks arising from the provisions of law, statutory

requirements and needs. To meet the needs in the development of these cognitive skills, the Police Academy in Szczytno has conceived the concept of a development project entitled *Development of a training interactive psycho-stimulator for the Police* which has been submitted for the contest No. 3/2013 announced by the National Centre for Research and Development for the implementation of projects in the field of research and development for national defence and security. The Director of the National Centre for Research and Development granted the Academy funds for the implementation of this project. It is worth noting that the National Centre for Research and Development (established in Warsaw, Poland) is an executive agency of the Minister of Science and Higher Education. It is a unit implementing the tasks of science policy, technology and innovation. The Centre provides a platform for effective dialogue between the science and business environments. The Centre is funded by the State Treasury and European Union funds.

The project fits in with the strategic objectives of the National Security Strategy of the Republic of Poland, i.e. creation of a strong scientific and research base, combined with generation capacity, improving the competitiveness of the economy and ensuring the safety of citizens, and the main objectives of the Europe 2020 Strategy[i]. It also corresponds with the OECD Innovation Strategies (Nowak, 2004) by promoting science and new technology solutions that can contribute to economic development and employment growth.

The project started in December 2012 and will last for three years. The Police Academy in Szczytno (Poland) is implementing this project in cooperation with the National Defence Academy (Poland). It should be noted that the Military Police officers carry out tasks to ensure organizational and legal order of sub-units of the military at home and abroad. In particular, it is the actions of investigative and operational compliance in the field of military order. In general, the analysis of the legal provisions, the provisions of statutory and practical examples show that there are many situations in which the armed forces are essential to ensure public safety. The third partner in the project is the company ALTA Ltd., which is one of the leading staffing companies operating in Poland. Since 1991, it supports its customers with expertise and design experience in the field of psychological research and human capital management. ALTA is known in particular from a wide range of proven psychometric methods and tools to support the daily work of the personnel and line managers.

3. AIMS OF THE PROJECT

The main objective of the project is to develop and implement an innovative system of diagnosis and training to evaluate and stimulate the cognitive competencies and psychomotor skills of officers. Product specific objectives, in turn, consist of:

- development of a diagnostic (assessment) and training (psycho-stimulation) system;
- development of psychophysiological module (necessary to extend the training to coping with stress);
- development of an advanced cognitive and psychomotor test;
- testing system for optimization and application of the technology demonstrator developed under the expected conditions.

Each stage of the project will be subject to testing standardization, optimization and validation of the system.

The developed system will enable an assessment of the efficiency of cognitive processes
and psychomotor skills and their online training. An additional function of this system will be psychophysiological module designed for training to cope with stress and an advanced system enabling a short and efficient evaluation of the efficiency of the psychological functions of officers before assigning them to particularly difficult and dangerous tasks.

Due to the novelty of the project, in the literature there are no data on the effectiveness of similar systems and diagnostic training in the police. Therefore, the study will provide knowledge of specific needs in terms of training, as well as opportunities for training of cognitive skills in the desired form in the environment of police officers.

4. STAGES OF IMPLEMENTATION

The research work carried out under the project relates to the effectiveness of modern methods of computer diagnosis of cognitive processes and online training of mental functions. The project started from research of a fundamental nature. The first task was devoted to the identification of key features determining the efficiency of an officer. In this task, we gathered knowledge and data used to construct the optimal psychological workout efficiency online. The architecture of the system was determined and then we checked whether it is congruent with the needs of future users. The criterion for assessing the usefulness of the technology (algorithm) was to verify the following assumptions:

- there is a need for training of cognitive functions among police officers;
- individual police positions require specific skills, which may be subject to training;
- police officers are active on the Internet;
- police officers use computer games spontaneously which favourably affects the efficiency of cognitive stimulation.

An important issue at the beginning of the project was to determine the psychophysical key features that affect the effective implementation of official duties, i.e. features with which the development may be useful in the work of the officer and consequently determine its efficiency. The study focused on basic cognitive functions necessary for the proper performance of duties by officers in executive positions.

4.1. The collection of data used to develop the diagnostic and training system

The diagnostic-training system will consist of a test module (evaluating the efficiency of cognitive processes and regulations), training algorithm and games developing cognitive skills. Combining the design of this system required exploratory research in two areas. The first area concerned the training needs. The second area of interest was, in turn, the officers. It was assumed that exercises stimulating cognitive processes must correspond to the real interests of officers.

4.1.1. Analysis of documents. Collecting the data needed to develop a system of diagnostic training started from the analysis of the records that consisted of job descriptions of officers from the selected organizational cells in the police. We analysed job descriptions and requirements of policemen performing investigative and operational reconnaissance tasks, police prevention, riot police, counter-terrorism and forensic experts. These documents were analysed for the tasks (and the specificity of these tasks), the powers and responsibilities of the job.

The Military Police in its essence and specifics of functioning is, in a manner, similar to the Police Force. The main areas of functional and organizational activities of the Military Police, among others, are in terms of investigation and operational-investigative activities. From that angle we analysed the specificity of tasks of officers in this formation.

4.1.2. Surveys. Information on psychological traits and cognitive skills relevant to particular positions were collected by surveys. In the study a group of 120 officers (80 police officers and 40 military police officers) participated. The aim of the survey was to diagnose the characteristics of psychomotor and cognitive competencies needed during conducting official duties. The results of the survey confirmed the theoretical assumptions that perception, concentration, persistence and divided attention, speed and accuracy in the analysis of the problem, logical thinking and drawing conclusions and working memory are of particular importance as key psychophysical features for the work of an officer. The separated components are important in the service of the Police and the Military Police, and, as studies have shown, they are not differentiated in officers due to the nature of their service.

At this stage of the project preferences for spending free time by officers, their interests, and in particular the involvement of computer games were also diagnosed. The data collected by the survey involving a group of 120 officers (80 police officers and 40 military police officers). Information obtained about the time spent on video games and gaming activities, as well as

preferences in this regard are important because individual cognitive training is to be based just on computer games. Results of this study indicated that 60% of respondents are willing to play computer games. Most often they mentioned strategy and logical games, adventure and role-playing games a little less. The data collected also identify the significant involvement of police officers in social activity; what is important is that the commitment focuses on specialized sites and police forums. It is also interesting that the most active group that use specialized portals are not young people, but people who are in the age group of between 41-50 years.

4.1.3. Development of computerized versions of tests included in the diagnostic and training system – A pilot study. The list of psychological functions which are of particular importance for the effective performance of official duties by officers became a part of the output for the next step of research, and was developed based on the results of the analysis of job descriptions and results of the survey. The list included the following functions: perception (detection functions and approximate visual attention); executive attention (concentration, divisibility and durability); working memory (range of material and processing speed of imaging, verbal, spatial and episodic material); decision making (speed and accuracy in the analysis of the problem and the forecasting of events); and efficiency of logical thinking and drawing conclusions.

At this stage the sets of psychological tests of cognitive performance monitoring for officers had been developed. The task of testing was to check the output level as well as monitoring progress in the development of selected components of cognitive skills. Two sets of tests were prepared. The first of these sets include numerical, verbal and logical exercises. The second set – consisting of two subtests – contain tests on concentration and test examining the level of working memory. The concentration and attention test consists of 80 tasks, in which subjects have to respond in an appropriate manner to emerging stimuli. In turn, a test examining the efficiency of working memory contains 40 tasks and relies on memorizing the position of letter symbols on a matrix, and then answering questions about their original location on the matrix. According to reports in the literature, tasks of storing spatial information turn out to be good tests of working memory, highly correlated with other more standard measures (Orzechowski, 2012).

Further research activities consisted of the pilot studies, in which the generated test was used. The study involved a 120-person research group (80 police officers and 40 officers of the Military Police). The tests were prepared on the online platform, the survey was anonymous (no personal information was collected) and lasted about one hour. Each of the participants logged on to the test by using the generated individual access code. Before the start of the tasks, the subjects got acquainted with the manual test execution, in case of doubt things were explained by the trainers. Each subject solved tasks individually; during the trial in the courtroom a trainer who motivated them to perform the test and monitored their progress was present. While solving the test the subjects could use pencil and paper sheets to make calculations. After the test, each person participating in the pilot study received information about the test result and duration of action.

The results of the pilot studies are the basis for selection of the most relevant and differentiating tasks to appropriately test, among others, perceptiveness, concentration of attention, working memory and analytical thinking. These tests will be developed within the next project tasks.

Parallel to the task entitled “Developing computerized versions of tests included in the diagnostic-training system”, diagnostic sets of interactive games to develop listed cognitive processes at different levels were produced.

4.2. Development of psycho-physiological module recorder

One of the specific objectives of the project is to develop a psychophysiological recorder module that will expand training for coping with stress. It was assumed that the user can be connected to simple sensors clipped to the fingers of the left hand and complete the task in the game requiring rapid action and high reflexes, yet some errors are associated with

exposure to a strong, unpleasant sound via the headphones. The system reads the psycho-physiological parameters and, after the game, presents a report describing the level of stress and the measures to facilitate its reduction. After performing several tasks, one will be able to assess the effects of the training. The tasks will change so that the user will not only learn the weakening response to specific stimuli, but also will develop a general habit of reducing pressure in stressful situations. The result of the task is to be a device to assess changes in the intensity of psychophysiological reactions (heart rate and galvanic skin response) integrated with games and software for analysis of results. It was assumed that some of the tasks would be performed under significant time pressure, resulting in rushing and (at least some) stress and disorganization of action.

The purpose of the module is, therefore, a psychophysiological measurement of the intensity of emotional reactions through the analysis of galvanic skin response and heart rate, and provide test feedback. In contrast to the classical biofeedback it will not be possible to monitor their performance on a regular basis (i.e. during the game), and only after its completion. It is expected that people actively training should focus on the task rather than on emotions. Interpretation of the results of the test will help to develop effective ways of coping in a stressful situation.

The work on the concept of psychophysiological recorder module was inspired by solutions used in the polygraph device. In a few words, we shall now refer to the essence of the polygraph test and the polygraph device itself (Krapohl & Sturm, 2012). The polygraph test is a method of human identification based on memory trace. It consists of summoning, registration (as a function of time) and the interpretation of the physiological effects of emotions associated with this track. In this procedure a device called the polygraph camera is used (developed in the 20s of the twentieth century in the United States), and which is now used to varying degrees in dozens of countries around the world (Konieczny, 2009). The object of study of the polygraph processes are emotional and physical correlates – physiological responses (Matté, 1996; Kleiner, 2002). Among the physiological correlates of emotions there may be mentioned, among others, temperature changes, changes in blood chemistry, change in the course of respiration, changes in the galvanic skin response in the cardiovascular system. For polygraph tests there were selected such physiological correlates of emotions that were easiest to record and observe, i.e. changes in breathing, blood pressure changes and changes in galvanic skin response (Widacki, 2011).

In modern polygraphs data are recorded with the following sensors:

- breathing patterns are recorded by pneumographs;
- by means of GSR sensors (galvanic skin response) the ectodermal activity is recorded reflecting the relative change in conductivity or resistivity of current in the tissue of the epidermis;
- the relative changes in the speed and pulse amplitude and relative blood volume are recorded by the cardiograph (Kleiner, 2002; Handler, Nelson, Krapohl, & Honts, 2010; Stern, Ray, & Quigley, 2001).

In the developed prototype module psychophysiological recorder two sensors are used, i.e. electrodes to measure the GSR and a sensor to measure heart rate (by fotopletysmography) (Stern et al., 2001).

5. FUTURE DIRECTIONS AND CONCLUSION

The end result of the project will be a fully functional web platform with the functions of the test and a training module, and an advanced test of cognitive and psychomotor skills.

Within each stage of the implementation of the established testing standards there will be optimization and validation of the system.

From the purely technological point of view, the innovative solutions, which are the result of the project, relate to the study of control algorithms and psychological training and psychophysiological data integration with the psychological system operating online.

From the psychological point of view the innovation of the project lies in the precise identification of cognitive and intellectual functions – which are crucial in the work of

uniformed officers – and the development of methods to foster these functions by training online as it has already been mentioned.

The proposed system is characterized by the following elements: it is set to develop the skills of people with at least average cognitive and psychomotor potential; its design is based on a task base developed on the achievements of modern cognitive science, and further verified in additional basic research, forming part of the project; the functionality of the system will be dedicated to the development of cognitive and psychomotor skills needed in the work of officers of the uniformed services; advanced test function will support the optimal selection of officers for difficult and dangerous tasks; the system will be equipped with a module of psychophysiological training support to cope with stress.

Implementation of the project should bring two major benefits. The first of these will be to improve the efficiency and effectiveness of the cognitive coping with stress for the Police and Military Police officers. Moreover, it will enable raising the quality of human resources, improvement of self-esteem and efficiency of mental work to increase the potential of these services. The second advantage is related to the implementation of the advanced testing features of cognitive and psychomotor efficiency. It will be done through enabling rapid and objective assessment of current predispositions to improve the efficiency and safety of groups performing difficult and dangerous tasks. Efficient law enforcement authorities have a strong influence on the security of the state and its citizens. Therefore, properly selected and trained officers, having insight into their potential and having opportunities to maintain a high level of cognitive abilities (through adequate training of the mind), provide a solid basis for the proper functioning of the organization.

REFERENCES

Handler, M., Nelson, R., Krapohl, D., & Honts, C. R. (2010). An EDA primer for polygraph examiners. *Polygraph*, *39*(2), 68-100.

Kleiner, M. (Ed.). (2002). *Handbook of polygraph testing.* San Diego, CA: Academic Press.

Konieczny, J. (2009). *Badania poligraficzne: Podręcznik dla zawodowców* [Polygraphic research: Handbook for professionals]. Warsaw, Poland: Wydawnictwa Akademickie i Profesjonalne.

Krapohl, D., & Sturm, S. (2012). Terminology reference for the science of psychophysiological detection of deception. *Polygraph, 31*(3), 154-239.

Lachowicz, Z. (1995). *Trening potencjału kierowniczego* [Training of managing potential]. Wrocław, Poland: Wydawnictwo Akademii Ekonomicznej.

Matté, J. A. (1996). *Forensic psychophysiology using the polygraph: Scientific truth verification, lie detection.* Williamsville, NY: J.A.M. Publications.

Nowak, A. (2004). Organizacja współpracy gospodarczej i rozwoju [Organization for economic cooperation and development]. In T. Łoś-Nowak (Ed.), *Organizacje w stosunkach międzynarodowych. Istota mechanizmy działania zasięg* [Organizations in international relations. The essence of the mechanisms of action reach] (4th ed., pp. 364-365). Wrocław, Poland: Wydawnictwo Uniwersytetu Wrocławskiego.

Orzechowski, J. (2012). *Magiczna liczba jeden czyli co jeszcze zmieści się w pamięci roboczej* [The magic number one or what else will fit in the working memory]. Kraków, Poland: Wydawnictwo Uniwersytetu Jagiellońskiego.

Stern, R. M., Ray, W. J., & Quigley, K. S. (2001). *Psychophysiological recording*. New York, NY: Oxford University Press.

Suchodolski, A. (2002). Rozwój i zarządzanie karierą pracowników [Development and management of employees' careers]. In T. Listwan (Ed.), *Zarządzanie kadrami* [Human resources management] (pp. 211-234). Warsaw, Poland: Wydawnictwo C.H. Beck.

Widacki, J. (2011). Kierunki poszukiwań nowych technik detekcji nieszczerości [Guidelines for searching for new techniques to detect insincerity]. In Agencja Bezpieczeństwa Wewnętrznego (Org.), *Normy prawne i standardy branżowe w zakresie badań poligraficznych w wybranych krajach: Materiały z Międzynarodowego Sympozjum Poligraferów, Emów 21-24 czerwca, 2010* [Legal and industry standards for polygraphic research in selected countries: Materials of the First International Polygraphy Symposium, Emów, 21-24 June, 2010]. Emów, Poland: Agencja Bezpieczeństwa Wewnętrznego.

ADDICIONAL READING

Kahneman, D. (2012). *Pułapki myślenia. O myśleniu szybkim i wolnym* [Pitfalls of thinking. About thinking fast and slow]. Poznań, Poland: Wydawnictwo Media Rodzina.

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[i] "Europe 2020 - A strategy for smart, sustainable and inclusive growth" is a new, long-term programme of socio-economic development of the European Union 2010-2020. The strategy was approved by the European Council on 17 June 2010. It replaced the Lisbon Strategy implemented in 2000-2010. The new strategy opens the discussion on the future of the Community economy and future direction of the European Union, based on the experience and achievements of the Lisbon Strategy. http://ec.europa.eu/eu2020/index_en.htm