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PERSONAL SECURITY AND POLITICAL LOYALTY ANALYZED WITH THE WELCOMEU SYSTEM BASED ON VIBRAIMAGE TECHNOLOGY

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Abstract: *This article discusses the main problems of profiling as a mean of behavior detection, loyalty detection and suspicious persons detection. Technical profiling systems are contrasted with visual profiling. The modern means of technical profiling, their advantages and disadvantages in comparison to each other are analyzed in detail. A novel approach for profiling based on vibraimage technology is presented.*

Keywords: *profiling, technical profiling, political loyalty, questionnaires, vibraimage technology, psychophysiological detection of deception, PDD.*

Loyalty relates to the dominant set of rules, values and norms of behavior in society. Accordingly, disloyalty manifests itself in the potential to violate the rules, values and norms of behavior, including criminal acts [1], established in a particular society. Profilers determine the state and intentions of a person, visually or during a survey. A selective inspection of passengers during pre-flight inspection is carried out in order to identify non-standard reactions to neutral questions. This kind of activity requires special training, which allows analyzing at one time a colossal amount of information received from the interlocutor: his appearance and clothing features, accepted posture and characteristic gestures, speech characteristics and vocabulary used, characteristic reactions and much more [2]. Today, one of the main functions of various security services is the prevention of crime and the identification and monitoring of suspicious persons. Modern security systems include various means of identifying the state and intentions of a person in order to predict his behavior. Usually such inspections are confined to profiling. Profiling is understood as a set of psychological methods for assessing and predicting human behavior, carried out by analyzing the most informative particular signs, like appearance and verbal and nonverbal behavior [2]. There are visual on-line profiling and technical profiling, which uses technical means of monitoring human behavior. Visual on-line profiling requires special training, which in a short period of time allows analyzing a colossal amount of information received from the interlocutor. Profiling of passengers at US airports is carried out through a system of behavioral analyses of passengers, called SPOT — Screening of Passengers by Observation Techniques. SPOT uses integral behavioral indicators characterizing levels of stress, fear and lies to characterize a person's emotional state. The main force in the SPOT project is the behavioral analysis by BDO (Behavior Detection Officers), visually analyzing the psycho-emotional state and human intentions, identifying individuals in passenger traffic whose behavior stands out from the general level [3, 4]. SPOT is targeted to identify potentially dangerous individuals. Other similarly focused behavioral risk assessment programs for prevention of criminal acts are: BASS (Behavior Assessment Screening System), BPRP (Behavioral Pattern

Recognition Program), BASC-2 (Behavioral and Emotional Screening System), TARR (Terrorist Activity Recognition and Reaction) et al. [5]. Any visual profiling technique is related to a lot of stress; a specialist profiler cannot work more than one hour without a break. Accordingly, developments in the field of technical profiling are becoming increasingly popular. Automation of the profiling system will minimize the number of errors induced through the involvement of human resources.

1. Vibraimage system as a tool for technical profiling

Vibraimage technology [6], applied to a person, analyzes the motor activity (micro vibration) of a human head and converts in real-time the light video image into an image formed by accumulated frame difference. Vibraimage reflects the average rate of change of the video image at each point calculated for a certain period of time. The obtained parameters of micro movements are transformed into the characteristics of the psychophysiological state (PPS), [6, 7] by vestibule-emotional reflex. Vibraimage technology combines the capabilities of biometrics and psychology, allowing to jointly process the parameters of conscious responses and unconscious responses to questionnaire stimuli and characterizing this joint processing with uniform mathematical parameters reflecting the human PPS. The obtained parameters of the vibraimage, in the form of integral profiles, make it possible to foresee human behavior in the near and distant future [8, 9].

WelcomEU [10] is a system of psychophysiological testing of a person based on the vibraimage technology. The system contains three different questionnaires (Id_leu, Id_leu2, Id_leu3), each of which includes 13 simple questions to be answered either Yes or No. Each question is supplemented with a stimulus photo. The questionnaire contains seven neutral (I), three control (C) and three relevant (R) questions. The test period is about 3.5 minutes. This time is sufficient to determine the trustworthiness / unreliability of a person.

2. Questionnaire structure

Unlike the classic detection of deception, where the control or comparative (C) and the relevant (R) questions form a pair [11], in the WelcomEU system [10] they are separated by a neutral question (I), leading to the following sequence: I*-CIRI-CIRI-CIRI [12]. The first neutral question (I*) of the questionnaire is the “zero” question. In the subsequent data processing, the I* is not considered. Data processing is carried out by two independent ways:

Method 1: It is based on the traditional comparison of the responses to control and relevant questions within the adjacent pair (comparison of the conscious and unconscious reactions). Naturally, both the control and the relevant questions provoke a rather strong emotional reaction (in comparison with the reaction to a neutral question). However, in the absence of sympathy or involvement with persons having an evil intention, the control question exhibits an increased individual significant psychophysiological response than in a relevant question. After all, a relevant question,

in addition to a stimulus photo related to it, can be interpreted directly to the potential activities of suspicious individuals. The uncontrollable psychophysiological reactions of an individual subjected to the WelcomEU profiling system to control questions will be more intense and hence detectable than on relevant questions.

Method 2: Comparison, within a pair, of the psychophysiological response (PPR) for control, relevant and neutral questions. This method was proven to be successful in cases where a person is trying hard to hide the truth. Hiding, imitating or over-controlling the expression of emotions during testing leads to an imbalance in the degree of intensity of psychophysiological reactions to control and relevant questions. Simplified, this process can be compared to the attempt of running through an obstacle; attempting to imitate a conditionally correct reaction to the obstacle (represented by a control or relevant question), leads to a general deterioration of health, an increase in energy consumption, which can be detected by WelcomEU systems. Because of this reason, the reaction to any neutral question is also quite intense. By analogy with the jump: the higher one had to jump (the degree of hostility caused by the control or relevant question), the greater the height is needed to fall (reaction to a neutral question).

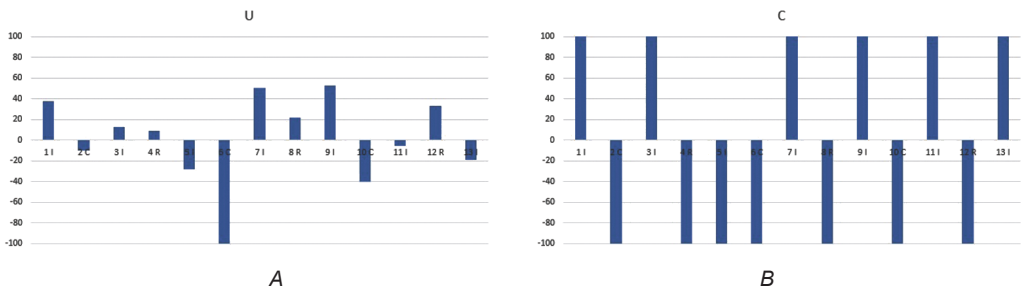


Fig. 1. A and B. Profiles of components of political credibility (U — unconscious reaction, C — conscious reaction, answers YES / NO) [8]

Analysis of the conscious reaction (fig. 1B) shows that the screened person consistently gave negative answers to all control and relevant questions [11]. At the same time, the analysis of the unconscious reaction (fig. 1A) shows that not all control and relevant questions received negative PPR, but only the control questions. The most unpleasant was 2, the control question serial number 6 C. The intensity of the reaction to the 2nd control question is 3 times higher than the intensity of the reaction to any of the relevant (R) questions. When $C > R$ it can be said that the person quite sincerely answered control questions and his conscious reaction coincides in meaning with the psychophysiological (unconscious) reaction.

In the analysis of conscious and unconscious responses to the questionnaire one sees that the unconscious human responses are the fastest, spontaneous and most decisive reactions when reacting on fast stimuli. The conscious responses are decisive for making decisions on non-spontaneous stimuli in time. Both of these psychophysiological reactions determine a person's personality; the analysis of only one component cannot characterize a person [13].

	U1	C1	U2	C2	U3	C3	$\Sigma U $	$\Sigma C $	$\Sigma U $	$\Sigma C $	ΣU	Σu_i	Res	Res'
C	-10	-100	-100	-100	-40	-100	50	100	73	200	50	73	NDI	NDI
R	9	-100	22	-100	33	-100	21	100	55	200	21	55		
lc	12	100	50	100	-5	100	23	100					NDI	
lr	-28	-100	53	100	-19	100	33	100						

Fig. 2. CRI tab, analysis of PPR for control (C), relevant (R), neutral or Irrelevant (I) — questions [11].

Captions: U (1, 2, 3) — PPR for 1,2,3 control (C) or relevant (R) questions; C (1, 2, 3) — conscious answer YES / NO to 1,2,3 control (C) or relevant (R) questions; lc — Irrelevant after the control; lr — Irrelevant after the Relevant; Res is the averaged result of PPR comparison to the control (C) and relevant (R) questions; Res' is the averaged result of PPR comparison for control and neutral (lc), for relevant and neutral (lr)

This information is presented in more detail in the digital equivalent of histograms, in the CRI tab, fig.2. Consider it in more details:

Method 1. Traditional comparison of the PPR to the control (C) and relevant (R) questions within the pair. The average PPR for control questions have values (50%), and the average PPR for relevant questions matters (21%). So the PPR for control questions is more than relevant, the result (Res) indicates that the person is telling the truth (NDI) and is politically loyal, not inclined to extremism in the extreme forms of its manifestation i. e. terrorism.

Method 2. Comparison, between couples, the first couple PPR for control (C) and neutral (lc), the second couple the relevant (R) and neutral (lr) questions. In method 2, the PPR is added between control question and the neutral question following it, then the second PPR is added between relevant question and the neutral question that follows it. After that, a comparison of the couples amounts received. In the given example, the sum of the PPR control with neutral is 73%, and the sum of the relevant with neutral is 55%, hence the second assessment of the control question is also greater than the relevant (Res').

Thus, a double check of political loyalty was carried out: the traditional way of comparing the PPR to the control (C) and relevant (R) questions, within the pair (method 1), and the comparison of PPR to the control (C) and neutral (I), relevant (R) and neutral (I) questions (method 2). The results coincide. Upon completion of testing with the help of WelcomEU, a database is formed of 11 files containing detailed information on the dynamics of the PPS throughout the test (Excel_M file) — information that is undoubtedly useful for profilers in solving controversial issues. You can estimate the ratio of negative (aggression, stress, anxiety) and positive and physiological reactions (inhibition and neuroticism), as well as the degree of their variability / resistance.

Conclusions

Modern security systems include various means of identifying the emotional state and intentions of a person in order to potentially predict his behavior. WelcomEU, based on the vibraimage technology, can be considered as the most modern technical profiling tool, with conscious and unconscious control of political loyalty. Currently,

the WelcomEU system is being tested in Russia and in EU (Cyprus). Even so, the profiling system contains a reference to the European Union (EU) it can, after successful implementation of the technical and specific requirements, be implemented as the most powerful biometric tool for monitoring migrants and passengers at border or immigration controls worldwide.

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