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Approach to verification of psychometric test results by integrating the methods of tempometry and video-oculography

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ABSTRACT

One of the function of psychometrics is to assess hidden properties in persons as trasmitters of meanings to predict their behaviour under certain specific situational conditions with reference to the measured parameters. When the survey participants recourse to deliberate distortion of their answers in order to increase social acceptability thereof, then there is a great probability that the evaluation and predictions of their behavior will not be relevant. The answer-response processing algorithms envisioned in standardized tests are often ineffective when it comes to detection of intentional distortion; and this in fact is the problem that requires resolution. An approach to solve this problem is proposed. A tool suitable for implementation of the proposed approach is described. The results obtained by means of using the toolkit Video Tsvetomer are illustrated.

Keywords: psychometrics, verification, behaviour, semantics, video-oculography

1. Introduction

Contemporary psychometrics, given the availability of relevant selection of methods in its research base, can describe in sufficient detail and scope the psychoprofile of the survey participant as well as the social profile of a group of persons in relation to the tasks to be solved (Messick, 1994; Miller & Lovler, 2018; Rust et al., 2020). By default, the results of psycho(socio)metrics obtained by reliable and valid methods are assumed to be accurate to certain extent (Messick, 1994; Miller & Lovler, 2018).

Nonetheless, when it comes to living beings, as opposed to objects of non-living nature, they are particularly rational beings able to manifest free expression of the will. High variability of possible reactions is common among them (Ben-Shakhar & Iacono, 2021; Kalantari et al., 2021; Kornienko, 2018; Suh et al., 2021). This makes it difficult to extrapolate the results of psycho(socio)metry to the conclusions on alleged behaviour of a person in some specific situational conditions. This aspect significantly reduces practical effect of the results of collective psychometrics.

The collective psychometric test results can be informative only in those cases when an apparently healthy survey participant, in their usual cognitive affective psychophysiological state, solves the test tasks sincerely, and provides truthful answers to them, without trying to mislead the researcher with deliberate distortions (Guyon, 2018).

When the survey participant has an incentive, intention and developed skills to give insincere, but socially acceptable answers, even if this is linked with deliberate falsification of their genuine attitude to the subject matter of a test task (elementary test task), then the participant usually chooses not those answers-responses, which honestly considers correct, but rather those that are acceptable (beneficial) in a particular situation (Guseva, 2019; Lavoie et al., 2019; Medina García & Rivera, 2016).

When the survey participant solves test tasks for themselves or in their own interests, then he or she would normally abide by the test instructions in a disciplined and sincere way. But when the survey is carried out in the interests of professional psychological selection (PPO), aptitude screening (AS), or for the needs of forensic examination, then the percentage of survey participants who deliberately distort their answers is quite high in these cases (Guseva, 2019; Medina García & Rivera, 2016).

In the time of all-around internetization, it is not difficult for anyone to gain access to whatever psychometric techniques. Consequently, easy access to the techniques makes it possible for any interested person to practice in advance to solve the test tasks in such a way, so that the needed result is obtained. Moreover, this result would equip the survey participants with characteristics they need, regardless of who they are from the psychological point of view.

The existence of this issue preconditions the relevance of further improvement of techniques and tools for socio-psychological (psychometric) examinations of the survey participants from different categories, as well as improving the mechanisms and algorithms needed to verify the responses to test tasks given by the test participants (Bauer et al., 2012; Belobrykina & Lemyasova, 2016; Ebdrup et al., 2019).

For historical reasons, in order to evaluate psychological characteristics of the test participants, most often used are the questionnaires, the answers to elementary test tasks (ETT) of which are easiest to distort (falsify) (Rust et al., 2020; Messick, 1994; Ivanov et al., 2019).

The survey results obtained by means of using other types of methods, such as sensorimotor tests, which do not explicitly research into psychological structure of the personality (worldview, self-esteem, intelligence, etc.) and least amenable to conscious control, are much less subject to deliberate distortions. This is because the deliberate slow-down of the speed of their sensorimotor reactions, if so desired, can be accomplished by many people; still very few of them can actually do it unnoticeably. It is near impossible to accelerate the time of one´s sensorimotor reaction beyond their psychophysiological capacities (Geiger et al., 2021; Tore et al., 2018; Korobov et al., 1987).

Classical definition of psychometrics implied work-sheet techniques, with their quite obvious possibilities and limitations. With the onset of personal computers (PCs), the computer versions of classical tests began to develop and improve. When solving test tasks in their computer version, it is possible not only to register the survey participants´ conceptual responses to test stimuli, but also to record the time it takes for the survey participants to perceive, comprehend and choose answers-responses.

Consequently, the computer-assisted psychometric testing makes it possible to obtain psychometric information about the survey participants simultaneously from different structural and functional levels of their personality: from conscious as well as unconscious.

The analysis of temporal behaviour (profile of sensorimotor reactions-responses) is an important channel to verify sincerity in the survey participants (Bauer et al., 2012; Ivanov et al., 2019).

In order to ensure highest reliability of the psychometric information obtained from the participants and (or) groups at the outcome of the survey, the employed methods should comprise mechanisms and indicators to verifying the answers-responses that are resistant to deliberate distortions (Meissner, 2021; Duchowski, 2017; Mushtaeva, 2014).

The purpose of the research consists in discussion of an approach aimed at improving verification possibility of the results of the psychological test tasks completed by the survey participants; description of the hardware and software tools needed to undertake the approach under study; and demonstration of the procedure aimed at obtaining psychometric data by means of the developed toolkit.

2. Materials and methods

The data from research studies (Messick, 1994; Kalantari et al., 2021; Medina García & Rivera, 2016; Meissner, 2021) were used as sources to supplement the iteratively replenished own survey database (Ivanov et al., 2019; Gnidko & Eremeev, 2020; Ivanov et al., 2020).

Semantic and color-semantic differential, sensorimotor examination (complex visual-motor response), free association (Ivanov et al., 2019; Osgood, 1964; Yanshin & Fomina, 2002; Guilbeault et al., 2020; Saysani et al., 2021; Cusinato & L'Abate, 2005) were employed as methods and techniques. Besides, analysis and synthesis of theoretical assumptions in psychometrics (Miller & Lovler, 2018; Rust et al., 2020; Messick, 1994) and results of the experimental studies (Ivanov et al., 2019; Gnidko & Eremeev, 2020), logical and statistical analyses of the obtained data, extrapolation and comparison of the results, abstraction and generalization in different combinations thereof were applied.

The toolkit consists of Tsvetomer program apparatus complex (PAC) together with Gazepoint H3 hardware and software system for video-oculography (eye-gaze-tracking) (Ivanov et al., 2019; Gazepoint H3). The technique implemented by using Tsvetomer enables sociopsychological, psychological and psychophysiological examination. It is a computer application which assists in performing individual testing of the survey participants (Figure 1). Video-oculography is informative in view of the eye behaviour specifics in the survey participants when they respond to various stimuli on the display. Video-oculography makes it possible to obtain data on perception of the stimuli by the survey participant, on what stimulus elements attracted their attention to the greatest extent, at what frequency, amplitude and speed the gaze in the survey participant moved from one stimulus to another, as well as on changes in the diameter of pupils and saccade parameters (the so-called vegetative dynamics in response to semantics and expression of stimuli).

Survey procedure. Based on voluntary and informed consent, 50 participants of both sexes participate in the survey. The male-female ratio in the sample is 2:3. The age of the survey participants varies from 18 to 24 (with the average age being 21 ± 3 (99% with $p<0.01$) years old). All survey participants are students of a Russian-taught university specializing in humanities. None of the survey participants has medical contraindications to prohibit participation in the survey.

Each survey participant is seated on a stand-alone basis at a computer workstation (Figure. 2). The participant is sequentially shown the next stimulus from the standardized list of stimuli (word or image; Figure. 1, 5a, 5b, Table 1) on the computer screen in the main working window of Tsvetomer.

Eight evaluation markers are given at the bottom of the main working window of Tsvetomer. The following color markers are used in the survey (left to right): red orange, lemon yellow, grass green, raspberry pink, dark blue, dark brown, asphalt grey, and black. (If required, Tsvetomer software makes it possible to replace the color evaluation markers with any other types, for instance, emoticons, hand markers, + and - symbols, yes, no, do not know, possibly, etc. In PAC Tsvetomer it is also possible to change the number of displayed evaluation markers in the range from 2 to 8. The choice of the evaluation marker type is determined by the survey objectives, as well as the survey expert preferences).

The instruction for the test session task stipulates that the survey participant, in view of their inner sense of connection between the next displayed stimulus (its content and image semantics, exterior) and the color of evaluation markers, must uncover a color-stimulus association (unification) by clicking on the evaluation marker so that with every following stimulus the two evaluation color markers are linked. (This procedure makes it possible to select two markers of the same color. For instance, green + green. In this case, the same marker requires a double click). Concurrently with registration of the color-stimulus associations, PAC Tsvetomer registers the time during which the survey participant uncovered this association. The association pattern looks as follows: stimulus No._N + evaluation_marker_1 + evaluation_ marker _2 + time between the presentation of stimulus N till the click on the first marker (T1 ms) + time between clicks on the first and second markers (T2 ms) + T3 = T1 + T2 (ms).

Consequently, the association pattern is outlined: stimulus No._N + evaluation_label_1 + evaluation_label_2. The elementary test task is displayed as a line: No. + Stimulus_name + Evaluation mark_1 + Evaluation mark_2 + T1 + T2 + T3 – a numerical value of the color pair index.

The theoretical grounds for this technique consist in modification of the semantic differential (Osgood, 1964; Lykova & Gordeev, 2018) by way of a color-semantic differential (Ivanov et al., 2019; Yanshin & Fomina, 2002; Guilbeault et al., 2020; Saysani et al., 2021) and the associative method

(Yanshin & Fomina, 2002; Cusinato & L'Abate, 2005).

The list of stimuli comprises calibration verbal stimuli [antonymic pairs of the meanings well known to the Russian speakers and taken from Dictionary of the Russian Antonyms by Lvov (1984)], as well as target stimuli (affective images taken from the Geneva database of emotiogenic images (Ivanov et al., 2019; Dan-Glauser & Scherer, 2011). The calibration verbal stimuli are represented by a standard example of test tasks (SETT)(Figure 3).

The calibration subtest of SETT equally allows obtaining data on the attitude of the survey participant towards the semantic content of the stimulus [the index of color pair (IC)] and temporal statistics (the graph ′True′ in Figure 2). These statistic data are informative as regards the speed of consideration in any particular participant, namely the speed of a complex sensory cognitive motor reaction with the sincere responses (clicks) to the test stimuli.

When solving SETT, there is no reason to falsify the results, because falsification can be detected through comparison of the results produced by the participant against an extensive database (N>3.000 people) obtained earlier. This makes it possible to identify deviations as regards the temporal behaviour in the participant. Besides, the value of IC and reaction time (T1, T2, and T3) can be used to draw conclusions on the participant's attitude to the semantic content of stimulus and the subjective degree of cognitive complexity of the stimulus for any particular participant.

The link below contains a video recording of a typical study session: [https://drive.google.com/open?id=1MyCVtxe7V5dVju8pWsmVNdgAOxJ8OkVW].

The principal aspects of using the color-semantic differential under Tsvetomer technique are the following:

1) compulsory use of two evaluation markers [one marker is used in the well-known analogues (Yanshin & Fomina, 2002)];

2) registration of time (ms) between the appearance of stimulus and the click on the first evaluation marker in the pair (color pair) (T1); between the click on the first evaluation marker and on the second (T2), and the total response time (T1 + T2 = T3). (Temporal parameters of behavioural reactions are sensorimotor and oculographic, when it comes to the measuring scale in millisecond. Even for a trained person, it is extremely difficult, if not impossible, to distort their reaction without revealing themselves through these attempts: either through typical changes in the temporal profile, or through color-semantic associations).

3) before the main testing, the calibration subtest of SETT is always displayed (Figure 3). The functional purpose of SETT is that by solving it, the survey participant comprehends and masters the principle of solving elementary

test tasks, i. e. color-stimulus associations, as well as practicing its solution. Besides, the result of SETT solution contributes to registration of a typical temporal profile of the cognitive affective motor behavioural pattern typical for any particular survey participant during any given session.

Pursuant to the procedure of the conducted survey, the elementary test tasks (ETT), namely questions and statements, used for the purpose of professional psychological selection of questionnaires (for instance, university applicants), were replaced with the stimuli given in Table 1. Notwithstanding that the computer-assisted technique Tsvetomer provides the possibility to consistently display any questions and (or) statements from any questionnaire tests, projective tests or case studies in relation to the tasks relevant for this stage of the survey, there were used not the original ETT from the standardized questionnaires, but those listed in Table 1.

As stated above, the qualitative responses to ETT of the questionnaires, namely agree/ disagree; yes/no/I don't know, etc., given in the boxes of evaluation markers, imply involvement of the conscious sphere of the survey participant´s personality. They are informative as regards this domain of psyche in the participants. The projective tests reveal the content-related properties of both conscious and unconscious spheres of the human psyche. The sensorimotor techniques have bioenergetic (unconscious) resources of the material substratum, i.e. neuro sensory muscular complex, through which the cognitive affective activity of the survey participant reveals itself through their behaviour under specific conditions of the physical and social environment and constantly adapting to it. In the context of this statement, the questionnaires are associated with the sphere of the survey participant´s personality, and its semantic constituent. The projective tests are related to the conscious and unconscious domains of psyche in the participants. The sensorimotor tests have the properties of the neural substratum, through which the psyche reveals itself in the physical world through the behaviour of the participants. All of these tests measure the split-level properties of the same survey subject, i.e. a person.

Consequently, the conscious, meaningful unconscious and sensorimotor spheres – the spheres that do not contain meanings represent a triune complex that shapes the psyche of persons (Rust et al., 2020; Huber & Klug, 2006).

One of the most ergonomic, informative and, thus, efficient ways to solve the problem of determination of the degree of sincerity in the survey participants when dealing with the test tasks is to combine several techniques based on different principles into one psychometric examination procedure (Bauer et al., 2012; Ivanov et al., 2019; Meissner, 2021).

It seems logical to assume that the psychometric test results would be most informative when the parameters of both conscious (which the survey participant may arbitrarily manipulate) and unconscious (constraint for conscious control) behavioural responses are simultaneously recorded throughout the survey procedure. For instance, the polygraph technique is based on this principle (Ben-Shakhar & Iacono, 2021; Mushtaeva, 2014).

In the series of examinations conducted in 2015 – 2020, the researchers implemented the above-described approach by means of developing a toolkit, i. e. PAC VideoTsvetomer (code name of the prototype) (Ivanov et al., 2020).

PAC VideoTsvetomer is based on the proprietary technology ©Tsvetomer, and is connected to Gazepoint H3 hardware and software complex for video-oculography (eye-gaze tracking). Both of the mentioned toolkits were part of a synchronously functioning psychometric system in these surveys.

Figure 1. Main working window of PAC Tsvetomer

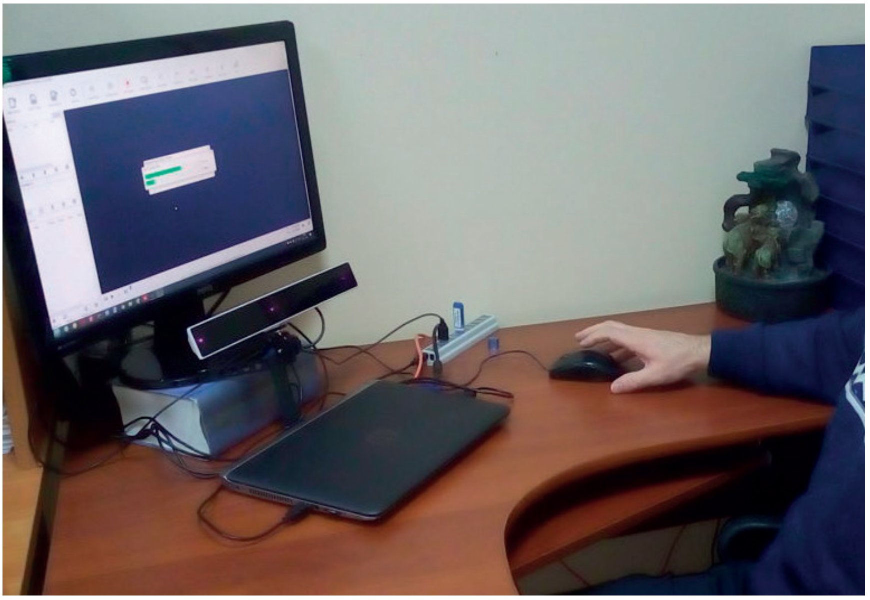

Figure 2. Design of PAC Gazepoint HD3 to carry out video-oculography

This research study focuses on the sequence of stimuli as given in Table 1. (The source of the image database is indicated in square brackets).

Table 1. Stimuli grouped into meaningful blocks

No.	Initial parameters subject to processing	Note
1	Words with positive and negative semantics from SETT database (ref. X-axis in Figure 4 and in research papers (Ivanov et al., 2019, 2020))	25 words
2	Photographs with neutral emotiogenic property from DB GDPED database (Dan-Glauser & Scherer, 2011) (N_color in Figure 6)	19 words
3	Photographs with negative emotiogenic property from DB GDPED database (Dan-Glauser & Scherer, 2011) - killed and suffering animals - human suffering (Sp-Sn_color in Figure 6) - snakes and spiders (Sp-Sn_color in Figure 6)	14 words 15 words 18 words
4	Photographs with negative emotiogenic property from DB GDPED database (Dan-Glauser & Scherer, 2011) (P_color in Figure 6)	22 items
5	Photographs with unidentified (surveyed) emotiogenic property (advertising banners randomly picked from the Internet and which are rated by the Internet users.	29 items

3. Results

The temporal profiles possess specific distinctions when the survey participants give SETT sincere answers-responses (True) and when they intentionally distort their answers-responses (Lie) (Figure 3).

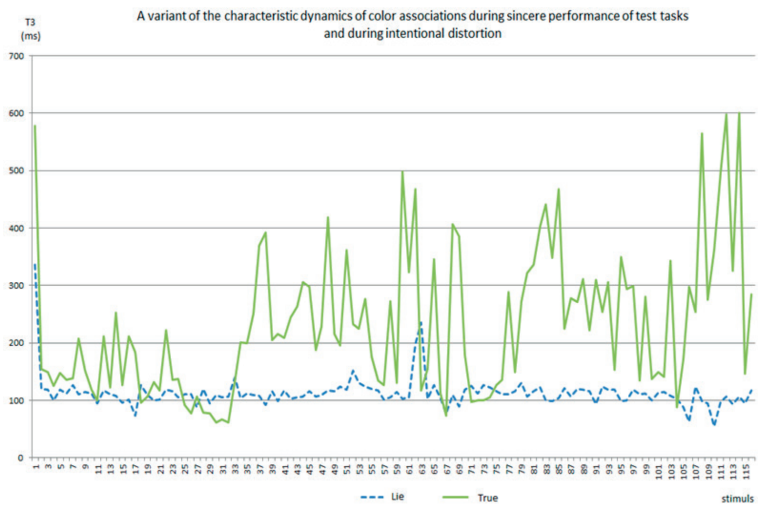

Figure 3. Temporal profile plotted on the basis of the response time (ms) values (clicks on the color markers by any survey participant) when the participant is shown a sequence of stimuli [X-axis has ordinal numbers to which the stimuli correspond. The first 20 of them are SETT words-stimuli (Figure 3)]. It makes it possible to state that conscious (truthful) associations take longer time than the thoughtless (falsified) clicks

Figure 4 shows a typical curve of the color-semantic differential for SETT stimuli in the Russian-speaking population in health surveyed in 2010 - 2020. The curve in Figure 4 demonstrates conscious attitude of the participants towards the meanings of the words-concepts from SETT. It is obvious that the words-stimuli of positive semantics have a color pair index (IC) above 0.50. For the words-stimuli from the negative semantic area, IC <0.50 is typical. The curve in Figure 4 visually represents a collective color-semantic profile of the participants from the surveyed sample. Configuration of this profile is typical for the adult Russian-speaking population healthy from the medical and psychological standpoint.

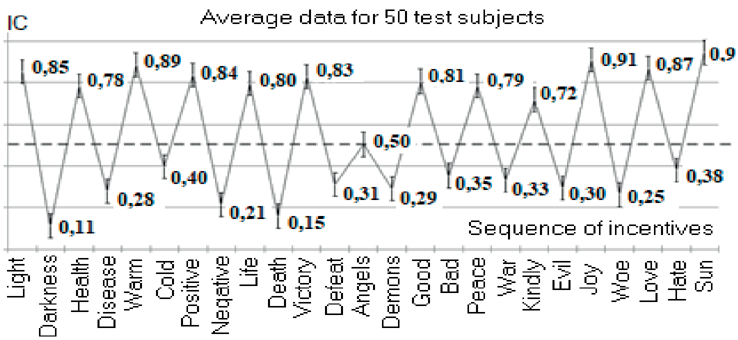

Figure 4. Semantics of color pair index (IC) for SETT stimuli based on the psychometrics results for 50 Russian-speaking survey participants. Pairs of antonyms in SETT are taken from a paper by Lvov (1984)

Figures 5a and 5b show the movements and focus of gaze in any particular survey participant when he or she responds to a graphic stimulus in a situation of harassment, and needs to select a color pair among the evaluation markers to confirm the choice of his or her attitude to the content and image semantics of the stimulus. Similarly, the visual contours of eye behaviour for any given stimulus are obtained for the rest of the participants in the sample.

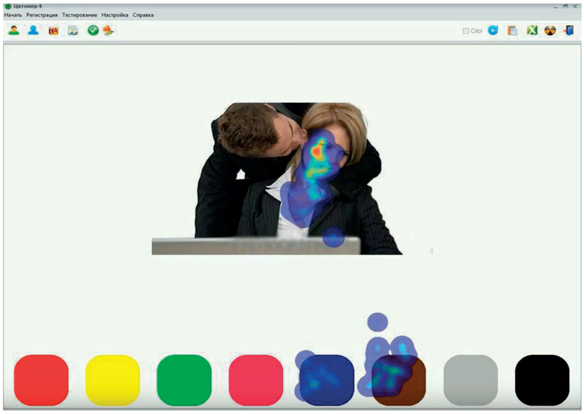

Figure 5a. Trajectory of movement and focus of gaze in the survey participants

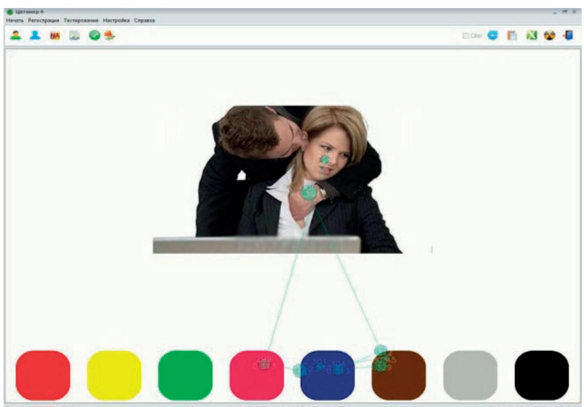

Figure 5b. Focus of gaze in the survey participants when the choice is made

Interpretation of visuals. When perceiving an image depicting a harassment situation, the survey participant intrinsically wanted to uncover the association of crimson pink + dark blue (the index of this color pair is 0.73, i.e. excellent ratio). Nonetheless, the color-stimulus uncovered by the survey participant was dark brown + dark blue with IC being 0.34, i.e. bad attitude. Consequently, in this case, there is an obvious falsification of the response towards a socially acceptable one.

4. Discussion

Consequently, PAC VideoTsvetomer enables simultaneous recording using the universal timescale of the following aspects:

1) Attitude of people towards meanings disclosed by the displayed stimulus regardless of the form in which this stimulus is presented (a word or phrase, graphics, video, etc.). Quantitatively, this ratio is expressed by the index of color pair (IC), with the range of possible values from 0.01 to 1.00 (IC from 1.00 to 0.55 means positive evaluation; 0.50 ± 0.05 - neutral attitude; from 0.45 to 0.01 - disgusting evaluation);
2) Evaluation of attitude of the survey participants towards the meanings disclosed by isolated stimuli and (or) combinations thereof. This technique makes it possible to connect the meanings inherent in certain stimuli with the meanings contained in other stimuli. At the same time, the participant is often unable to rationally explain the presence of some semantic connection between (color-)associatively related stimuli-concepts, even though the sense of such connection being present is often confirmed during the post-test interview;
3) Temporal characteristics of behavioural reactions accompanying conscious choices, both sensorimotor (speed of color-stimulus associations - T1, T2, T3) and video-oculography parameters (duration of gaze focus (ms) on the stimulus, speed (ms), number (items/per unit) and amplitude (pxl.) of saccades, dynamics of pupil diameters (pxl.))

The problem, the solution of which is undertaken in this research study, consists in the low degree of development of algorithms to verify the responses of the survey participants to the test tasks in standardized questionnaires, regardless of any particular methodology.

There are different ways to solve the problem of verification of the answers to the test tasks. Different techniques are implemented. For instance, Mind Reader hardware and software complex, the use of a contact polygraph (Ben-Shakhar & Iacono, 2021; Mushtaeva, 2014), video-oculography (Brishtel et al., 2020; Dan-Glauser & Scherer, 2011), profiling procedures (Meissner, 2021), etc. Each of these methods has its own advantages and disadvantages according to the ways of their application, the tasks solved by employing them, and other circumstances when this technique is used.

The technical solution as proposed by Authors, on one hand, provides an opportunity to research into semantic content of the consciousness and subconsciousness in the survey participants in a way traditional for collective psychometrics; and, on the other hand, to simultaneously carry out objective monitoring of behavioural reactions. The scope of behavioural reactions, in turn, particularly when the complex of sensorimotor micro reactions is taken into account, is hard to distort in such a manner that the hardware and software complex does not immediately signal a credible and non-coincidental change in temporal characteristics when the survey participant formally solves the same type of test tasks.

The compiled psychometric measuring database makes it possible to give an affirmative answer to the question whether simultaneous registration of multilevel psychometric parameters defining the psychological, sensorimotor and behavioural pattern in the survey participants, which develops during the solution of test tasks.

At the same time, it is possible to avoid any necessity to make the process of solving these tasks more complicated for the survey participants.

The combination of methods of color-semantic differential, thermometry and video-oculography (eye-gaze-tracking) in the same procedure provides an opportunity to obtain an array of psychometric data from different structural and functional levels in persons: conscious (attitude to the meanings found by them in the displayed stimuli), semi-conscious or unconscious (sensorimotor reactions to stimuli), and unconscious levels (eye reactions).

The database of survey participants available at the moment offers a great scope and obvious heterogeneity of parameter configurations. In order to extract hidden patterns from it, the application of Data Mining methods is envisioned (Gnidko & Eremeev, 2020).

The preliminary analysis of the obtained results indicates that the color-semantic differentiation of words-stimuli is well achieved in relation to content and image semantics of the stimulus.

The speed of color associations (temporal parameter) is proportional to the subjective cognitive complexity of meaning and image of the presented stimulus. Besides, it is also linked with the strategy of the survey participant as regards the performance of the test tasks in a particular manner (truthfully or falsely).

The parameters of eye behaviour help to understand, out of which variants of evaluation markers reviewed by the survey participant, he or she chooses that particular color pair, through which he or she uncovers the color-stimulus association. If the rendered choice of color pair differs from the options under consideration, the system enables checking the alternative results, as if the color-stimulus association would be achieved by those evaluation markers that the participant considered for about the same time as those that he or she would eventually choose. Let us illustrate this statement by an example.

The color-verbal associations to the verbal stimulus of joy show that this word is a typical representative of the words-concepts with a positive psychosemantic field. (IC of joy usually (in 86-96% of cases ($p \leq 0.0$) 1) equals to 0.90 ± 0.01 c.u.). In this case, the survey participant needs about 270 ± 50 ms to understand the meanings (actualization of associations connected with this word-concept in a particular way in their memory) associated with joy, and to express their attitude. Consequently, in terms of cognitive load, this term is simple (the speed of associations ranges from 30 to 150 ms, and is interpreted as an unconscious reaction. 151 - 350 ms is a rapidly progressing conscious association. 351-500 ms is the average speed of uncovering the associations, interpreted as an obvious necessity to think (to comprehend). 501 ms or more is a cognitive load task [ref. to statistics in Figure 3 (´True´ line)].

The visual analysis of oculogram when the survey participants responded to the word-concept of joy proved, that the configuration of gaze movement is similar to the one that is typical for demonstration (presentation) of easily recognized stimuli.

Figure 3 gives the statistics of results for the color-verbal associations for words of the calibration subtest SETT.

Figure 6 gives the statistics of color associations for SETT stimuli and graphic stimuli (see legend for Figure 6 for more details).

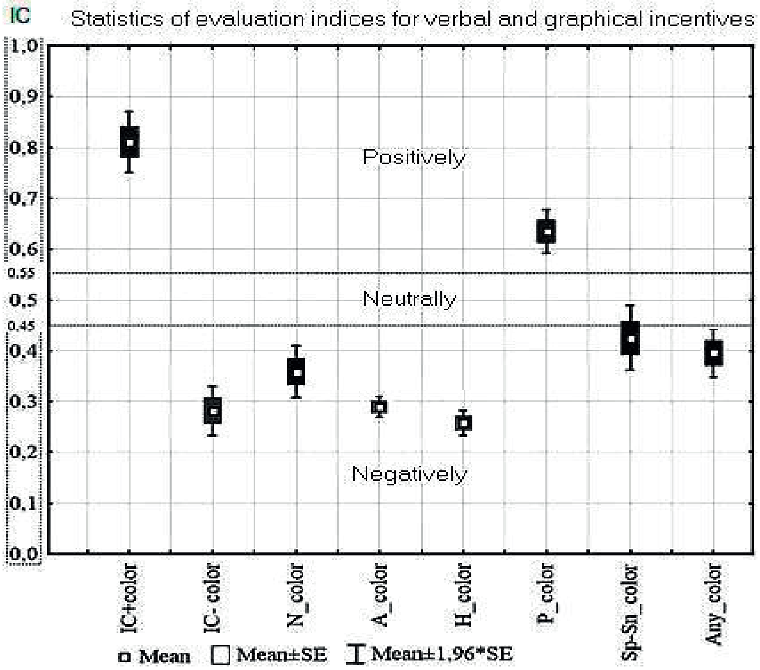

Figure 6. IC statistics for different groups of stimuli

Figure 6 represents that: "IC+color" is the value of the color pair index (IC), obtained for the set of verbal stimuli of SETT, constituting the semantic field of positive meanings: light, health, heat, positivity, life, victory, angels, goodness, peace, kindness, joy, love: IC>0.55; "IC-color" is the value of the color pair index, obtained for the set of verbal stimuli of SETT, constituting the semantic field of negative meanings: darkness, disease, cold, negativity, death, defeat, demons, bad, war, evil, grief, hatred: IC<0.45; "N_color" is the value of IC, obtained for the set of displayed graphic stimuli from GAPED DB database, and possessing, in accordance with the statement by the developers of this standardized database of images, neutral emotiogenic property; "A_color" is the value of IC, obtained for the set of graphic stimuli from GAPED DB database, and possessing negative emotiogenic property (photographs of killed or suffering animals); "H_color" is the value of IC, obtained for the selected set of graphic stimuli from GAPED DB database, and possessing strong negative emotiogenic property (photographs of suffering people, including children, human bodies with signs of violent death, as well as various criminal scenes; "P_color" the value of IC, obtained for the set of graphic stimuli from GAPED DB database, and possessing positive emotiogenic property (photographs depicting various positive content displayed to generate such emotions as joy, affection, pleasure); "Sn-Sp_color" is the value of IC, obtained for the set of graphic stimuli from GAPED DB database, and aimed at experiencing predominantly negative feelings (photographs of snakes and spiders displayed to cause disgust and rejection); "Any_color" is the value of IC, obtained for the set of studied graphic stimuli (various images from the Internet) of the initially unknown emotiogenic property; "Mean, Mean±SE, Mean±1.96*SE" is statistics from Statistica 10.0 program, with the mean value of the parameter, mean ± standard error, mean ± one standard deviation multiplied by the standard error respectively.

The analysis of the data given in Fig. 6 makes it possible to draw the conclusions as follows:Block "IC+color" contains statistics of the verbal stimuli with positive semantics.

Block "IC-color" reflects the evaluation of verbal stimuli with negative semantics. Less significant dispersion of statistics for the stimuli with negative semantics is typical for the general population of survey participants. This is most likely due to the fact that everything bad is more clearly and expressively identified in people´s personal worldviews than everything good (the good is more blurred).

Block "N_color" contains statistics revealing the attitude of the survey participants towards, so to say, graphic stimuli with non-emotiogenic property, and being emotionally neutral (in accordance with the statement by the developers of these standardized stimuli from DB GAPED (Geneva)). Nonetheless, pursuant to the firm impression developed in Authors of the research study, when a person is given the task to express their attitude towards the stimulus in a rational way (using words as means of assessment), the mental processes get activated. Then the survey participant evaluates ordinary, well-known household items (an electric light bulb, a lamp, etc.) as positive. From the rational point of view, this is so. Nonetheless, when a person is asked to express their attitude to the form and content of a graphic stimulus through predominantly an irrational channel (color markers), then the emotional component of psyche works. Through this component it is possible to reveal that the outwardly inexpressive images that do not possess any emotiogenic property are evaluated not as neutral, but rather as neutral-negative. This phenomenon implies that the result of solving the test tasks depends on the class of evaluation markers (for comparison, the ´maxima as the question so the answer´ is appropriate here).

Blocks "A_color" and "H_color" demonstrate the expected attitude among the survey participants towards the form and content of stimuli depicting suffering animals and people. The evaluation here is clearly negative. At that, the dispersion of statistics in this case is minimal.

In "P_color"-block, the results are also predictable: photographs with positive content are displayed. These photos are evaluated positively as well.
In "Sp-Sn_color"-block, the photographs of snakes and spiders are shown. As envisioned by the developers of DB GAPED, perception of insects and reptiles should generate disgust and rejection. Nonetheless, among the survey participant, the emotional experiences in response to these stimuli were not definitive. The students of psychology do not consider snakes or spiders as strongly repulsive.

The interpretation of the results reflected in the "Any_color"-block is of particular interest.

At this stage of the research, it is possible to state that, in overall, the static content is assessed by our compatriots quite in a negative way (IC≈0.39 ± 0.05 c.u.). While processing the experimental data, the video-oculography parameters were superimposed upon all the results obtained by means of "Tsvetomer".

The research continues. Its preliminary data are indicative of a complex relations between the gaze parameters and the parameters of color-stimulus associations in response to stimuli of different type and content. Further development and validation of models and algorithms is required to enable comprehensive description of the hidden patterns in relations between the recorded psychometric and psychophysiological parameters typical for cognitive affective vegetative behavioural activity in the survey participants during the ongoing session.

5. Conclusion

For the purposes of providing the solution to the problem of improving the level of verification as regards the psychometric results, the research toolkit is proposed for use. In the course of a typical psychometric session, the toolkit is able to simultaneously register the parameters of cognitive, sensorimotor, autonomic and behavioural patterns, all of which develop in the survey participants in connection with their perception of the test stimuli of various content and image semantics.

Technical capabilities of the developed toolkit are discussed; and the preliminary results obtained with its help are illustrated.

The points relevant for further research are stated.

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