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Section 1. Geology

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ENGINEERING AND GEOLOGICAL PROPERTIES OF EOCENE CLAYS OF THE NORTHERN TAMDYTAU AS THE BASIS FOR ENGINEERING STRUCTURES

Abstract. The article studies clays with high moisture content of the lower horizons of the Northern Tamdytau section, where weathering and salinization is weak, which contributes to their swelling growth up to 19.7%. It is noted that these clays should be classified as slightly swelling – to a depth of 2.0–2.5 m, medium swelling – to a depth of 3.0 m and heavy swelling – from 3.5–4.0 meters or more. The increased swelling value of the lower horizons of clays is because climatic and technological factors do not have an impact on lower horizons in terms of their original material composition and properties.

Keywords: moisture, clays, swelling degree, swelling value, swelling pressure, soil body, groundwater regime, technological factors, hypergenesis.

Recently, the problem of construction development of territories formed by swelling soils is very important. Underestimating and ignoring the swelling properties caused damage to many industrial and civil buildings and structures. Although the swelling processes make the construction and operation of buildings and structures significantly difficult, the areas of their distribution are actively developed. This is due to the lack of available territories for construction with pace showing an upward trend.

Gain in moisture of swelling soils leads to the foundations upheaval located therein and the formation of negative friction for pile foundations. There are instances where some structures uphove to 580 mm when foundation soils swollen. The soil shrinkage causes structure settlement after drying-out [3; 4; 5]. In some cases, the horizontal swelling pressure on underground structural elements is also dangerous. These studies are highly relevant because active industrial and economic development of territories inevitably leads to imbalance of components of the environment. The groundwater regime is changing, and the soil body moisture is increasing. Comprehensive study and assessment of urban agglomeration

territories and areas of development is one of the most important objectives of engineering geology.

The purpose of the study is to develop a study of technologically impacted soil bodies formed by swelling rocks based on the analysis of identified and justified patterns of formation of their composition, properties and alterations in the hypergenesis zone.

A significant contribution to the study of the methodological features of swelling clays and the identification of their genesis was made by M. F. Vikulov, M. Z. Zakirov, V. A. Frank-Kamenetsky, A. A. Sabitov, V. I. Osipov. Later, the swelling processes in different regions were studied by G. A. Mavlyanov, A. M. Khudoybergenov, A. M. Samedov, M. M. Zakirov and many others.

The mineralogical composition of soils has a significant impact on the ability to swell. Other things being equal, soils containing montmorillonite in the clay fraction are larger than those containing kaolinite. Kaolinite, having a rigid crystal lattice, interacts with water molecules and hydrated cations (sorbs them) only with its external surface, and montmorillonite, having a sliding crystal lattice (package structure), interacts not only with the external surface, but also to a greater extent with the internal surface of structural layers, that is, these particles are able to absorb water.

It is known that depending on the weakening rate or disappearance of rigid structural bonds, as well as on the rate of formation of adhesive films around solid particles, swelling occurs not immediately after soaking the soil, but within a certain time. With unlimited flow of liquid, the swelling ends when the propping forces are balanced by the applied pressure.

These studies analyze the causes of clay swelling and clay minerals and explain the swelling processes from the perspective of capillary theory, using the aqueous colloidal hypothesis and as a complex physical and chemical process occurring under capillary, adsorption, osmotic and other factors. Thus, swelling is a complex physical and chemical process caused by the presence of water in an inter-wrapper space of the clay mineral crystal lattice, by natural structural bonds accompanied by compositional changes of exchangeable cations, by interaction of solid particles with pore solutions, by capillary phenomena, etc. The extent to which these processes influence the clay swelling varies and depends on their mineral, chemical composition, dispersion, physical and other properties [1; 2].

At the same time, the temperature factor is important, since the swelling increases with increasing temperature, although it is poorly studied [2; 3]. The influence of material composition of different genetic types of clay rocks on the swelling degree has been poorly studied. Physical and mechanical properties of clay rocks are formed throughout their geological history, from the moment of sedimentation and further transformations during the diagenesis, catagenesis, and hypergenesis processes [4]. When swelling rocks are moistened, it contributes to their softening and disturbance of their natural structure, loss of strength characteristics, transition from a solid and semi-solid consistency to a plastic consistency. These properties of clays should be taken into account in engineering and geological surveys to justify construction projects.

Currently, the clay swelling can be limited or prevented by applying external pressure [1; 2; 3; 4]. The degree of clay swelling decreases with increasing external load. Deformation does not occur if the external load is greater than or equal to the swelling pressure.

The swell value of studied clays, determined by the shake method (in test tubes), is 1.6–10.5 times greater than the initial one (undisturbed structure). There is an increase in the degree of clay swelling with depth. Near surface layers, where there is a greater impact of superimposed (secondary) processes, show the smallest swelling. To a depth of 3.0–3.5 m, the swelling increases by 0.8–2.8 times. In the depth range of 3.0–3.5 m, the swelling is stabilized from 6 to 8 times. Dramatic changes in the swelling values are observed for all samples in the load range from 0 to 0.1 MPa, especially in the range of 0–0.05 MPa.

Numerous studies have shown that at a pressure of 0.1 MPa, the swelling is 2.0–2.5 times less than

at free swelling. Accordingly, the swelling stops at a pressure of 0.35 MPa. This means that when the pressure exceeds 1.0 MPa moistened clays do not swell. Such behavior of swelling clays is important when designing structures in urban territories of the Northern Tamdytau [5; 6].

The clays of the upper horizons swell despite the weathering and salinity. Increased clay moisture in the lower horizons, where weathering and salinity is weak, contributes to an increase in their swelling value up to 19%. The studied clays of the Northern Tamdytau should be classified as slightly swelling – to a depth of 2.0–2.5 m, medium swelling – to a depth of 3.0 m and heavy swelling – from 3.5–4.0 meters or more. Numerous swelling measurements of clay samples with natural moisture content from 10 to 25% confirm their high swelling capacity.

Based on the above, the following conclusion can be made:

– there is a gradual increase in the values with the depth of swelling degree, swelling moisture and swelling pressure;

– relatively low indicies of eocene clay swelling in the upper layer of the section are attributable to geological and geomorphological condition, small amount of natural moisture and high evaporation of precipitation, development of weathering processes, salinity with sulfate and bicarbonate salts;

– increase in the swelling value of the lower horizons of clays is due to the fact that climatic and technological factors do not have an impact on lower horizons in terms of their original material composition and engineering-geological properties.

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Section 2. Study of art

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THE PREREQUISITES FOR THE EMERGENCE OF BALL

Abstract. The article identifies specific prerequisites (historical, social, cultural, artistic) on the basis of cause-and-effect method, which created a favorable ground for the birth of ball — a unique socio-cultural and social-art phenomenon with a centuries-old history that has not lost its relevance to to the present time.

Keywords: ball, ball as a cultural practice, genesis of ball culture, ball ontology, elite, Etiquette norm, secular art, dance program.

Back in Antiquity, the ancient Greek philosopher Empedocles of of Akragas (ca. 490–430 BC) formulated one of the important principles of ontology, according to which "nothing comes from nothing …". In other words, the birth of a phenomenon can only take place if there are certain reasons for it. In this article the author will attempt to identify specific prerequisites for the emergence of ball phenomenon — a unique socio-cultural and socio-artistic phenomenon that has not lost its relevance to the present time. The algorithm for solving the given objective will be based on cause-and-effect relations. At the same time, we will first formulate an effect in the form of a basic postulate, after which we will address the definition of the cause causing it.

Postulate one: Ball is a purely European phenomenon, the origins of which, like the origins of the entire European culture, dates back to ancient times.

In ancient Greek symposiums (from Latin "symposium" and Ancient Greek "συμπόσιον" — "feast") and ancient Roman feasts, which were purely men's leisure time and arranged for communication and recreation on various occasions, organized an entertainment, consisting of wonderful dancing heteras (they also served at the feast and could also communicate with men by entering into a conversation), as well as invited dancers; artistic performances; performances of instrumental and vocal music by kithara and aulos players; various games and contests. At the same time, the organizers of these feasts acted as spectators, not leaving their seats for the dining tables — apoclinters. The feast was followed by the Symposiarch, his chief administrator. Comparing these ancient festivals with balls, it is not difficult to notice many things in common — the festive spirit, the presence of artistic, communicative (verbal) and

game components, the concert and entertainment program, the meal itself and, as a result, the pleasure of being at these events.

Also in the Antiquity period, important semantic "signs" appear, under which, many centuries later, the ball will be born. Among these "signs" developed by the intellectual elite of antiquity (philosophers Socrates, Plato, Aristotle, Heraclitus, Pythagoras, Epicurus, Democritus) are the most important aesthetic categories of beauty, harmony, moderation, catharsis, kalokagathia, hedonism and others. Furthermore, as early as in the Ancient Greece and Roman times, a special attitude towards art in general and dance in particular can be observed; its importance in educating the body and spirit of ancient citizens is noted.

In the context of ball ontology the period of Antiquity can be considered as a period that prepared aesthetically fertile ground for the genesis of ball culture.

Postulate two: Ball is a phenomenon born of an elite environment.

Aware of their exclusivity, the medieval elite sought to make their lives as exceptional and exemplary as possible, including its idle side. In this respect it is impossible to pass by the figure of Charlemagne — king of the Franks, who went down in history as one of the greatest monarchs, famous not only for military victories, but also for his desire for enlightenment and culture, passion for art. Having gathered the most educated people of his time at court, he initiated the creation of the so-called "Palace Schools". It is no coincidence that the years of this monarch's reign (768–814) went down in history as the "Carolingian Renaissance". Certainly, the actions of Charlemagne, which prepared the necessary cultural and artistic ground for the emergence of ball, can be considered as one of its important prerequisites.

In addition, among the medieval elite (important feudal lords and noble knights) various forms of leisure solidified, among which a special attention was paid to dances usually held on the occasion of the conclusion of another knightly tournament (or other significant event). The dance program of the late Middle Ages involved not only knights, but also ladies. It was the gender principle that determined the specificity of the compositions that made up this program, which was to represent pair dances. During their performance, the gentleman showed special respect and reverence for the lady. Over time, thanks to the formation of the so-called "Code of Knightly Honour" (this code was finally formed only in the XIII century.), the dance practice was better embodied, becoming one of the ways to demonstrate chivalrous kurtuosity and called ball.

The appearance in the dance program of medieval festive events of paired dances, in which both men and women participated, was another important prerequisite for the birth of the ball.

Postulate three: Ball is a strictly regulated phenomenon, subject to etiquette norms.

This principle is most directly related to the previous one, because the elite attached great importance to a special system of behavior and communication, seeing it as a kind of "marker" of their choice. Originally, this "code" of etiquette was the "Code of Knightly Honour" already mentioned by us, based on the knight's piety towards the fair sex.

In this place, we have come to a very important point that touches upon the very essence of ball culture, based on the worship of the Lady of the Heart. This veneration of the Woman in worldly ceremonies was a natural consequence of worshipping the Virgin Mary in the Christian cult (especially its Catholic branch). As noted by A. P. Baturin and N. D. Polischuk, due to Christian views of the cult of the Virgin Mary "…The Beautiful Lady, who served as a knight, became the image of his spiritual love. < … > the position of a troubadour in relation to his lady copies in every detail the position of a Catholic believer in relation to the Virgin Mary and other saints. Like a believer, a lover experiences in the contemplation of his lady all the stages of the mystical vi-

sion of the deity" [1, p. 17]. The elevation of the Lady by the knights, her peculiar "iconization", played a huge role in raising the social status of women in medieval Europe, helped her "…to get out of her lowly condition" [1, p. 19].

The observance of the rules of the "Code of Knightly Honor" by medieval knights and their special attitude towards women in the context of secular festivals was also one of the prerequisites for the emergence of ball.

Postulate Four: Ball is a purely secular phenomenon.

In accordance with this principle, it is obvious that the development of secular art, in particular musical art, is a prerequisite for its emergence. This process is accelerated at the turn of XII — XIII centuries. thanks to: (a) The activities of jugglers who actively performed at court festivals and, in some cases, were enrolled in court service as organizers of spectacles and festive events; b) the work of troubadours, trumpeters and minnesingiers, which gave rise to the first examples of secular vocal lyricism (including the genre of "dance song", samples of which often accompanied the performance of aristocratic medieval dances); c) the development of musical instruments (according to numerous reports, by the 14th century). It was represented by more than thirty different instruments, including wind instruments — trumpets, horns, flutes, bagpipes; string instruments — harp, crwth, rebab, vielle, fiddle [2, p. 107].

"Entry into the avant-scene" of secular art in the late Middle Ages can be regarded as another prerequisite for the emergence of ball.

Postulate Five: Ball is a kind of artistic complex based on the interaction of arts and implies the creation of special conditions for its performance.

One of such conditions is the change associated with the dwelling of the feudal lord. For example, throughout the late Middle Ages ascetic castle construction was gradually replaced by the construction of magnificent palaces, in which the protective and defensive function was replaced by the grand presentation. It was the palaces, with their magnificent, in detail thought-out exteriors and interiors, that turned into amusing residences of monarchs and noblemen of the highest rank, who in their daily lives aspired to "…exorbitant luxury of clothes, jewelry, weapons and furniture; in all this the gentlemen tried to surpass each other, especially demonstrating their worthiness at tournaments, festivals, feasts and dwelling" [3]. The Palace of the feudal lord became the "hearth" of cultural life, performing in the medial epoch simultaneously the functions of a concert hall, museum, entertainment institution, home for receptions and audiences.

Therefore, by the end of the XIV century on the basis of the abovementioned prerequisites a favorable ground for the birth of ball was prepared. The next stage, connected with the development of the ball and its "transformation" into a very visible sociocultural and social-artistic phenomenon, will be the Renaissance.

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Section 3. History and archaeology

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EARLY SETTLEMENTS OF CENTRAL ASIA AS A FACTOR OF FORMATION OF FIRST SOCIETIES (ON EXAMPLE OF THE SETTLEMENT OF SARAZM)

Abstract. The issue explores the interpretation of the formation of the first societies in Central Asia. The role of the settlement of Sarazm in the development of social relations and social structures in the region is studied. On the methodological aspect, the method of generalizing analysis of archaeological, etymological and source studies is chosen. The application of this method made it possible for the first time to determine and clarify the transitional stages from primitive to urban culture and civilization in human history.

Keywords: Sarazm, Avesta, village, settlement, sociality, kind, neighboring community, tribe, society, structure.

Introduction. The Eneolithic period in archeology is assimilated as an era by the invention of man of the first ore from copper metals. Therefore, researchers of different spheres of historical science consider the Eneolithic period a rapid development after the "Neolithic revolution" of production farms: agriculture, handicraft and cattle breeding, as well as the emergence of trade in the form of trade between different communities, tribes and nationalities. The study of Eneolithic settlements in Central Asia began at the beginning of the 20th century by the archaeologist R. Pumpelli [1] and has been systematically continued to this day. Archaeological excavations in Central Asia gives researchers the opportunity to compile a geographical map of the monuments for the periods of the Eneolithic and Bronze [2; 129]. This article does not provide for exploring the ar-chaeological study of the Eneolithic and Bronze Ages. I wanted to carefully analyze the social development in these ancient settlements on the basis of a scientific synthesis of studies of archeology, etymology and source study.

Sarazm is an ancient settlement located 15 km west of the current city of Panjakent (Tadjikstan). In the monument, the life of settled communities existed for one and a half millennia, with the greatest flowering during the periods of the Late Eneolithic and Early Bronze Age. According to researchers, the settlement arose as a result of migration processes, the general appearance of architecture, material culture, economy, cults indicate its southern origin (Southern Tukmenistan), associated with the zone of settled agricultural crops that formed during the Neolithic period. The basis of the economy of the in-

habitants of Sarazm was agriculture and cattle breeding, and various specialized industries, primarily metallurgy, were of no small importance. The main metallurgy deposits of Yori, Kanchoch and Dzhilau were 40–50 km east of the settlement. In such an abundance of deposits, from the end of the fourth millennium BC the settlement became one of the largest centers of ancient metallurgy in Central Asia. Jewelry findings, like gold and silver beads, as well as waste from jewelry production-lapis lazuli, turquoise and other minerals show a high development in jewelry art. And the findings of bracelets adorned with obviously imported sea shells and vessels of northern Iranian origin proves that Sarazm was an amazing center for crossing a wide variety of ties and trade contacts [3]. Thus, the favorable natural and environmental conditions of the settlement of Sarazm allowed its inhabited communities to develop about 100 hectares of land.

Topics. The most pressing problem of historical sciences today is to study the development of social relations of communities, the emergence of estates living in settlements such as Sarazm at the time of the formation of cities and early civilizations. One of the reasons for the complication of the social organization of settled farmers and cattle breeders is the possibility of living in one place, in one settlement, a significant number of people. According to studies, we know that during the Neolithic period, the average population of the villages amounted to 100–300 people [4, 153], from 50–70 to 150–300 inhabitants lived in small villages of the Jeytun culture, and even 600–800 in large villages [5, 142]. It is likely that population growth due to land tightness led to resettlement, traced, in particular, in two directions: to the north, to the Zeravshan valley, and to the south, to Seistan. Another reason for the complexity of the structure of society is the need for exchange between neighboring and remote villages. Environmental conditions that largely determine the characteristics of the economy, even in small areas were not completely identical, which led to some specialization of

economic activity. Thus, farmers and cattle breeders of the Eneolithic were interested not only in land favorable for agriculture, but also in areas promising in relation to the possibilities of extraction, processing, and exchange of minerals.

Theoretical review. It should be noted that the interpretation of archaeological cultures and finds, according to the scientific refinement of the transitional stage of humanity from primitive to the emergence of cities and civilizations, has always depended and continues to depend on theories developed by ethnographers, ethnologists and sociologists [2, 193]. The current degree of development of historical thinking, in our opinion, on the basis of even a brief analysis of studies of source studies and etymology gives us some answers in this direction. Thanks to research in the field of source studies, we find such evidence that society was formed in a slow and long-term process of merging several and different tribal communities, primarily in places where the climatic conditions enabled the communities to switch to settled life. We find such facts in the Avesta, which was considered the holy book of the religion of Zoroastrianism, distributed in agricultural and settled cattle-breeding communities of Central Asia and Eastern Iran in the first half of the 1st millennium BC. Here we did not want to analyze in detail the history of the study of the Avesta, we only pay attention to the terms that were used in the most ancient parts of this book as a designation of the main social structures, which were organizations that formed the society itself in the territories of modern Central Asia.

The lowest structure of society in the Avesta is the term "nmana" ("dmana"), which means "house" as the family's dwelling, as well as its household (Yasna, XXXI-16.18; Yasht, V-38.62.63; X-28.30; XVII-6.8). At the head of the family house is the householder – "nmano (dmano) paty", literally the head, the owner of the house. In turn, related family homes form a kind under the term "vis". The same term also refers to the ancestral village in the Avesta. The "vis" becomes a patriarchal kind, the totality of

"nman (dman)", united by descent from a common ancestor and called by the name or nickname of this ancestor. According to the Zoroastrian tradition, at least 15 families should be part of the kind [2, 220]. In the oldest parts of the Avesta, the kind is the main unit and carrier of the most important political, social and legal institutions. Pastures, fields, and the simplest irrigation facilities were the property of the "vis". At the head of the kind is "vispati" – master, master of the kind, usually the oldest of the kind. Since "vis" is not only a kind, but also a kind village, the "vispati" in the Avesta also acts as the head of the kind village. In the Ghats, according to researchers of the emerged part of the Avesta during the period of the prophet's activity, there is evidence that the kind village`s were part of the territorial communal associations called "vrzana", which denoted the villages of the neighboring community [6, 185]. "Vrzana" in the Ghats stands in line with the terms "hvaytu" – family, relatives, and "aramyan" – a union of fellow tribesmen, possibly also a cult union [7]. In addition to "vis" and "vrzana", the term "gava" is mentioned in the Avesta – a village, a rural district, denoting a settlement of farmers and settled cattle breeders. There is also such a structure as "gava-shayana" or "gava-shiti" – in translation it means living in a village – the names used in the tenth Yashta to characterize the central belt of the earth, opposing the northern steppes inhabited by nomads [8]. Perhaps here we are talking about the first settlements with fortifications. The term "gava" appears in the same text, in combination with the Avestan geographical name Sogd: "gava Suguda" – Sogdian settlement. It should be noted that in our opinion it is here that the first signs of society appear, or we can get the primary evidence and facts about the formation of society itself [9, 28].

The development of new lands and pastures, the creation of irrigation facilities, and the complicated practice of water distribution to a large extent contributed to strengthening the importance of the neighboring community, and led to an ever greater decomposition of the principles of the clan structure. The settlements of farmers and settled cattle breeders gradually turn out to be more based on economic ties than on purely tribal ones. Special designations also appear for the rural district-territory belonging to the neighboring community and encompassing several different tribal villages along with their pastures and fields. In the Ghats, the term "shoytra" is used, which denotes a rural district, tribal area, tribe [Yasna, XXXI-16; XXXII-10], and at the same time in Wispered, cultivated land, counties, land unit to which water, land and plants belong [Wispered, XVI-3]. The full next stage can be called a tribe, which is already mentioned in the Little Avesta under the term "zantu" quite rarely. This is consistent with the real situation of the tribe in the Avestan society. Unlike houses and a kind, the tribe enters the settlement of farmers and settled cattle breeders as a formal community, the degree of kinship is important inside the "vis" and "vrzan", only the fact of kinship is taken into account in the tribe. A larger unit than a tribe or region occupied by several tribes in the Ghats is defined by the term "dahu" [Yasht, XV-31]. In the Avesta, "dahu" is primarily a territorial, geographical concept, often indicating a significant ethnic community, but it is not yet a clear administrative unit within the existing state.

Thus, the early settlements, which formed from various tribal community-villages, in the process of slow merging in the development of a productive economy formed in society. In other, no hints of the presence of cities, urban life, which are considered the main criteria of civilization, are not emphasized in the Avesta. There are no special terms for the citadel. Analyzing the above terms in the Avesta, which denoted mainly the social structures of Central Asia and East Iran in the last quarter of the second and first half of the 1st millennium BC, it can be firmly established that in fact we should consider the word and concept of society as the primary element and category of civilization. And we can assume that the first societies are this voluntary community of peo-

ple, various tribal communities and tribes having a single territory, or rather real pastures and fields for the development of a productive economy, a common religion, language and culture [9, 30–31].

Result and Discussion. The analysis allows us to draw the following conclusions:

1. The study of the early settlements of Central Asia on the example of the Sarazm monument has an important scientific priority in the study of the transitional stage of human history from primitive to civilization.

2. Historiography on the study of the settlement of Sarazm shows that the early settlements were formed on the basis of a long process of merging various primitive communities, more precisely kind`s. In this process, producing farms, mainly agriculture and a settled lifestyle, have become decisive factors.

3. And of course, the sociality of mankind made it possible to strengthen the relationship between different communities. It was manifesting their social qualities that primitive communities at the time of civilization began to form and develop new social relations. In our opinion, such a long process went through a paradigm in a sedentary way with the life of primitive communities: a) small patriarchal family villages; b) tribal community-village; c) territorial neighboring community-rural district; d) the first societies – settlements.

3. The early settlements of Central Asia, and the planet Earth as a whole, is the primary point in the formation of urban culture, various spheres of production economy and service, political genesis, religion, science and art. From this point of view, it can be established that the early settlements are actually the first societies in the history of mankind. And also, the first societies are the paramount sign of civilizations.

4. Further research on the historiography of various disciplines of historical science will provide new opportunities to clarify the stages of formation of ancient civilizations.

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Section 4. Medical science

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BACTERIAL DYSBIOSIS RISK PREDICTION ACCORDING TO VAGINAL NORMOBIOTA INDICATOR

Abstract. Vaginal bacterial dysbiosis is evident by the progressive growth of obligate and optional anaerobic bacteria, myco- and ureaplasmas and fungi against the background of a sharp decrease in the number of lactobacilli.

The aim of those work was to establish prognostic factors and the risk of bacterial dysbiosis development according to the vaginal normobiota indicator based on the comprehensive analysis of the state of systemic and local immunity and hormonal regulation. As conclusions, with bacterial dysbiosis the pathological regulatory hormonal-immune system is formed, which contributes to the vaginal dysbiosis progression. In accordance with this, dysbiosis can be considered as a dysregulatory pathology, and the identified indicators of the "interleukin cascade" as its markers.

Keywords: bacterial dysbiosis, IL2, IL4, TNFα.

Introduction

Despite certain success achieved in the treatment of female genital organs inflammatory diseases, the prevalence of these diseases is increasing steadily and, according to various authors, ranges from 26% to 40–45% [1, 472; 2]. Internal female genital organs non-specific inflammatory diseases occupy one of the main places in the gynecological pathology structure, which is one of the main medical problems and has a significant impact on the health of millions of childbearing age women [3]. These processes occur against the background of a very noticeable deterioration in reproductive health and determine the development of obstetric-gynecological pathology that determines the health of a mother and fetus [4, 143–148; 5, 859–864].

Women internal genital organs chronic inflammatory processes should be considered as a common multisystem disease. It is accompanied by the involvement in the pathological process of all parts of the systemic regulation of organs and body systems [6, 1399–1405].

Bacterial vaginosis (BV) is an infectious non-specific non-inflammatory syndrome, which is the final variant of the bacterial dysbiosis development, and is evident by the growth of obligate and optional anaerobic bacteria, myco- and ureaplasmas, fungi against the background of a sharp decrease in the number of lactobacilli [1, 472; 3; 7, 555–563]. The main place in the BV pathogenesis takes the disorder of the coordinated functioning of the hormonal and immune regulation of the vaginal secretions coloni-

zation resistance, leading to the shift in the microbiota towards the pathogenic factors [4, 143–148; 5, 859–864]. The local and systemic immunodeficiency is accompanied by the disorder of the vagina normal microbiocenosis and the antimicrobial substances secretion [8, 283–291].

According to the data [9, 1–5], BV is characterized by a significantly reduced systemic and local inflammatory response against the activation of cytokine cascades, corresponding to the increase in BV-associated microflora [10, 481–487].

Based on this concept, it seems relevant within the framework of one comprehensive study to establish the main links in the pathogenesis of bacterial dysbiosis and select marker factors for its development.

Purpose of the study is to establish prognostic factors and the risk of developing bacterial dysbiosis according to the vaginal normobiota indicator based on the comprehensive analysis of the state of systemic and local immunity and hormonal regulation.

Material and methods

This study uses examination data of 298 women aged from 16 to 64 who saw gynecologist for a preventive examination or with complaints of genital discomfort. Criterion for exclusion was the presence in the vaginal epithelium scrapings of definitely pathogenic microorganisms (*Trichomonas vaginalis, Neisseria gonorrhoeae, Chlamydia trachomatis and Herpes Simplex Virus 1,2*). Presence in the smear of more than 15–20 leukocytes, which indicated of an inflammatory reaction, was also the reason for exclusion from the number of patients.

During the examination, scraping of epithelium from the posterolateral vaginal paries was made using a urogenital probe. Molecular and genetic studies were performed by the real-time Polymerase chain reaction (PCR). DNA was extracted using the Proba-GS reagent kit (LLC DNA Technology, RF). Amplification of the tubes with the reaction mixture was carried out in a DTLite thermocycler (DNK-Technologiia LLC, RF). Investigation of vaginal biocenosis status was performed using Femoflora 16

test system, designed to perform real-time PCR. Microbiota was quantified by the following indicators [11, 30]: Total bacterial mass (TBM), normobiota (*Lactobacillus spp.*), Obligate anaerobes (ObA; *Atopobium vaginalis, Eubacterium spp., Gardnerella vaginalis, Prevotella bivia, Porhhyromonas spp., Lachnobacterium spp., Clostridium spp., Megasphaera spp., Veilonella spp., Dialister spp., Mobiluncus spp., Corynebacterium spp., Peptostreptococ spp., Sneathia spp., Leptotrihia spp., Fusobacterium spp.*), optional anaerobes (*OpA; Enterobacteriaceae spp., Staphylococcus spp., Streptococcus spp.*), myco- and ureaplasmas (MU; *Ureaplasma urealiticum + parvum, Mycoplasma hominis + genitalium*) and yeast-like fungi (*YF; Candida spp.*).

According to the PCR results, the Opportunistic pathogenic microflora index (OPMI) and normobiota index (PNB) were calculated: OPMI = log $((\Sigma 10OA + \Sigma 10\Phi A + \Sigma 10MP + 10DG) - 10LB)$ NBI = = lg3БМ – lgЛБ, where ObA means obligate aerobes; OpA – optional anaerobes; MU – myco and ureaplasmas; YF – yeast-like fungi; LB – lactobacilli; TBM – total bacterial mass. According to OPMI, patients were divided into two groups: with normocenosis (OPMI was lower than –1 lg GE / sample; n = 53) and dysbiosis (higher than –1 lg GE / sample; n = 245) [11, 30]. With dysbiosis, the NBI index reflected its degree and ranged from 0 lg GE / sample to 7.2 lg GE / sample. The NBI value above 1 log GE / sample (the number of such cases was amounted to 83) indicated the maximum degree of dysbiosis and corresponded to the state of BV [12, 54–57; 13, 103–7].

According to the standard immunological methods [14, 960; 15, 576], there was determined the content of immunoglobulins A(IgA), M(IgM) and G(IgG) in the blood serum and vaginal secretions (Granum NVL test systems; Ukraine) and the content of immunoglobulin G2(IgG2) and secretory IgA(sIgA) (Hema, LLC; RF); the transforming growth factor content 1β(TGF-1β) (DRG; USA); immune complexes (IC, in vaginal secretion) and circulating IR(CIR, in blood) by the method of selective precipitation in polyethylene glycol solution;

the interleukins content 1β (IL1β), 2 (IL2), 4 (IL4), 6(IL6), 8(IL8), 10(IL10), tumor necrosis factor α (TNFα) and γ-interferon (γ-INF) (Vector-Best, LLC; RF); the complement components content C3 and C4("PLIVA-Lachema Diagnostica s.r.o"; Czech Republic); lysozyme (DRG; USA).

The leukocyte phagocytic activity (LPA) was determined using the yeast cells suspension (Granum, NPL, Ukraine); LPA was calculated as the average number of particles absorbed by one active neutrophil per 100 cells, the LPA index (ILPA) as the percentage of phagocytes from the number of counted neutrophils. The number of lymphocytes in the blood (L) was calculated [14, 960]; quantitative determination of CD3 +, CD4 +, CD8 +, CD16 + and CD22 + cells was carried out using erythrocytic diagnosticum of Granum, NPL (Ukraine), the immunoregulatory index (IRI) was calculated as the ratio of CD4 + / CD8 +. The pH of the vaginal secretion was determined using the Kolpo-Test Ph test strips manufactured by Biosensor AN, LLC (RF). By applying the enzyme-linked immunosorbent assay there was determined the content of hormones in the blood serum:: luteotropic (LT), follicle-stimulating (FS), prolactin (PL), cortisol (C), progesterone (PG), estradiol (E2), testosterone (TS), free triiodothyronine) and free thyroxine (T4) using reagent kits manufactured by the Granum NPL (Ukraine).

The influence of factor variables on dependent indicators was studied using one- and multi-factor linear and non-linear regression analysis [16]. There were calculated the regression coefficients (β), the reliability of their differences from the null hypothesis, the correlation coefficients (R) and determination (R2) for linear models, as well as the value of Wald statis-

tics and the maximum likelihood coefficient for non-linear ones. The operational characteristics (sensitivity, specificity and correctness) of the logistic models were evaluated using ROC diagrams. The prognostic models building was carried out using neural network modeling. The genetic analysis method was used to select the most significant factor characteristics. In all types of comparative statistical analysis, the significance of differences was taken at $p < 0.05$. For statistical processing of the data obtained, Statistica 10 software package (StatSoft, Inc., USA) was applied.

Results and Discussion

At the previous study's stages, we have analyzed the microbial biocenosis indicators, vagina colonial resistance, immune system and hormonal regulation system during the vaginal dysbiosis development and BV [17, 583–595; 18, 103–7; 19, 84–90]. The formation of a single pathological hormonal-immune system, which is formed under conditions of vaginal dysbiosis and supports its development, has been shown. Such a system included the formation of local and systemic immunodeficiency and a number of hormonal disorders.

The task of this work was to identify the most informative indicators that objectively reflect the state of the pathological process and the severity of dysbiosis. The NBI (variable Y) was considered as the resulting sign, while in the case of normocenosis, the variable Y acquired the value Y = 0, and in the case of dysbiosis – Y = 1. The analysis was carried out for the examination results of 298 female patients, 53 of whom were diagnosed with normocenosis, and 245 of whom were diagnosed with dysbiosis. As factor signs, 58 indicators were subjected the initial analysis (Table 1).

Table 1. – Input signs of the initial analysis of the vagina colonial resistance, immune system and hormonal regulation system indicators

X1	Age	X20	IL10	X39	CD22+
X2	Day MC	X21	TNFα	X40	LPA
Indicators in VS:		X22	TGF-1β	X41	I_{LPA}
X3	IgM	X23	pH	X42	CIR

X4	IgA	Indicators in blood:		X33	C3
X5	IgG	X24	FS	X44	C4
X6	IgG_2	X25	LT	X45	γ-INF
X7	sIgA	X26	E_2	X46	IL1β
X8	Lysozyme	X27	PG	X47	IL2
X9	LPA	X28	TS	X48	IL4
X10	I_{LPA}	X29	C	X49	IL6
X11	IC	X30	PL	X50	IL8
X12	C3	X31	fT_3	X51	IL10
X13	C4,	X32	fT_4	X52	TNFα
X14	γ-INF	X33	Lc	X53	TGF-1β
X15	IL1β	X34	CD16+	X54	IgM
X16	IL2	X35	CD3+	X55	IgA
X17	IL4	X36	CD4+	X56	IgG
X18	IL6	X37	CD8+	X57	IgG_2
X19	IL8	X38	IPI	X58	sIgA

Notes: MC – menstrual cycle; VS – vaginal secretion

To check the quality of the model forecasting, all observations (using a random number generator) were divided into three sets: training one (used to calculate the model parameters, 248 cases), control one (used to control model re-training, 20 cases) and confirming set (used to check the model adequacy when new data forecasting, 30 cases) [16, 208].

On a complete set of 58 factor signs, a linear neural network model was built and trained. The model sensitivity built on the full set of factor signs on the training set was 99.4% (95% CI 97.6% –100%), specificity – 100% (95% CI 97.7% –100%), on the confirming set the model sensitivity was 100% (95% VI 88.8% –100%), specificity 100% (95% VI 87.3% –100%). The sensitivity and specificity on the training and supporting sets were not statistically significantly different (p = 0.15 and p > 0.99, respectively, when compared by the χ^2 criterion), which indicates the adequacy of the constructed model.

To identify factors that are most associated with the dysbiosis risk according to NBI, a selection of significant signs was performed using the genetic ALT algorithm method. As a result, three factor signs were selected: blood levels of IL2 (X47), IL4 (X48) and TNFα (X52).

On the selected set of three factor signs a linear neural network model was built and trained. The linear neural network model sensitivity built on three factor signs on the training set was 80.5% (95% VI 74.1% –86.2%), specificity 82.1% (95% VI 73.1% –89,6%), for the confirming set, the model sensitivity was 81.3% (95% VI 57.1% –96.7%), specificity 92.9% (95% VI 71.9% –100%). The sensitivity and specificity in the training and supporting sets were not statistically significantly different (p = 0.80 and p = 0.54, respectively, when compared by the χ^2 criterion), which proved the adequacy of this model.

To identify the possible nonlinear factor signs relationships with the risk of dysbiosis development according to NBI, a nonlinear neural network model (such as a multilayer perceptron) forecasting (model architecture is shown in Fig. 1) was also built on the selected set of signs.
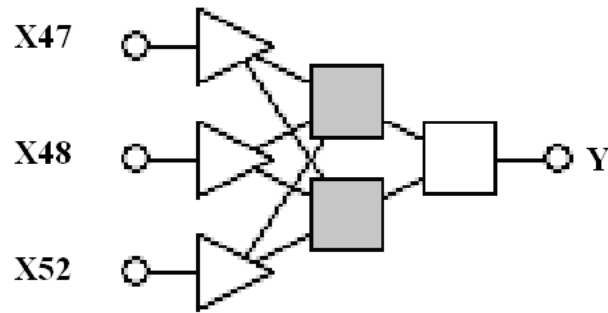
Figure 1. The architecture of the nonlinear neural network model for predicting the risk of dysbiosis development according to NBI (triangles indicate the neurons of the input layer, gray squares indicate the neurons of the hidden layer, and a white square indicate the neuron of the output layer)

Upon optimization of the model acceptance / rejection threshold, the following was obtained: the sensitivity of this model on the training set was 100% (95% VI 98.8% –100%), specificity 69.0% (95% VI 58.6% –78, 6%), for the confirming set the model sensitivity was 100% (95% VI 88.8% –100%), specificity 85.7% (95% VI 60.8% 99, 0%). The sensitivity and specificity on the training and test sets were not statistically significantly different (p> 0.99 and p = 0.34, respectively, when compared by the χ^2 criterion), which indicated the adequacy of the built model.

To assess the models prognostic characteristics, the method of constructing operating characteristic curves (ROC curves – Receiver Operating Characteristic Curve) of models (Fig. 2) was applied.
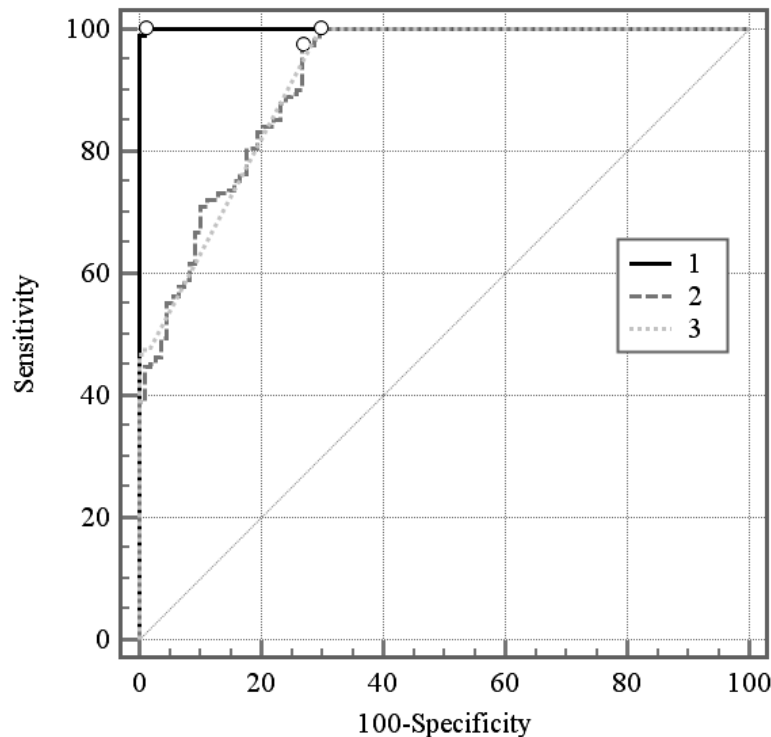
Figure 2. ROC-curves of the dysbiosis risk predicting models according to NBI
1 – Model built on all 58 factor signs; 2 – Linear neural network model, built on three selected factor signs, 3 – Nonlinear neural network model, built on three factor signs

When conducting the analysis, the area under the ROC curve of the linear neural network model built on all 58 factor signs, AUC1 = 1.00 (95% VI 0.99–1.00), was statistically significantly (p <0.001) different from 0.5. The area under the ROC curve of the linear neural network model built on three marked factor signs AUC2 = 0.92 (95% VI 0.88–0.95) was statistically significantly (p <0.001) different from 0.5. The area under the ROC curve of the nonlinear neural network model built on three marked factor

signs AUC3 = 0.92 (95% VI 0.88–0.95), was statistically significantly (p <0.001) different from 0.5. Since the quality indicators of the linear and nonlinear models did not actually differ, a simpler linear model was left for the further analysis.

To identify the strength and direction of the three selected factor signs effect, the logistic regression model was analyzed; the model turned out to be adequate (χ^2 = 221.4 at p <0.001). The coefficients analysis results are shown in (Table 2).

Table 2. – Coefficients of the three-factor model for predicting the risk of dysbiosis development according to normobiota indicator (logistic regression model)

Factorial sign	The forecasting model coefficients values, b ± m	Differences significance level from 0	OR (95% CI OR)
X47	0.20±0.07	0.002*	1.22 (1.08–1.39)
X48	−0.31±0.17	0.070	–
X52	0.10±0.03	0.001*	1.11 (1.04–1.18)

Notes: OR – odds ratio; CI – confidence interval

From the logistic regression model coefficients analysis, it follows that the risk of dysbiosis development according to NBI increases statistically significantly (p = 0.002) with the IL2 level increase in the blood (OR = 1.22; 95% VI 1.08–1.39, per unit; ng/ml). The dysbiosis development increase risk (p = 0.001) according to NBI was also established with the increase in the level of TNFα in the blood (OR = 1.11; 95% VI 1.04–1.18, per unit; ng/ml).

Earlier, we found [17, 18] that the level of all proinflammatory cytokines in the blood, which include IL2 and TNFα, was increasing with dysbiosis degree increase, and reached a maximum in BV (when compared with normocenosis in 3.0 and 3, 6 times, respectively; p <0.001). At the same time, it was shown that the activation of the "inteleukin cascade" was both systemic and local in nature, and the systemic (in terms of levels increase) turned out to be 1.5–2 times higher.

In the blood, the level of anti-inflammatory cytokine – IL4 decreased in subgroups in accordance with the dysbiosis stage, which was maximally expressed in BV (5.5 times) [17]. In general, the level

of pro-inflammatory cytokines, as opposed to proinflammatory ones, with the BV development decreased sharply, and not only in the blood, but also in the vaginal secretion. Maybe that's why the significance level of differences from the 0 coefficient of the logistic regression model for the factor sign X48 (IL4) turned out to be statistically insignificant (p = 0.07; see Table 2).

The main reason for the BV development is the formation of local immunodeficiency, which reduces the vaginal secretions colonization resistance, antimicrobial substances impaired secretion and providing local immune defense [4, 6]. In addition to local, immunodeficiency with BV also acquires a systemic character [8].

With bacterial dysbiosis, increased levels of proinflammatory interleukins are found in the vaginal secretion [9], which correlates with the increase in the number of Gardnerella Vaginalis and Mycoplasma hominis [10]. According to data [20], *Gardnerella vaginalis* is able to reduce the cytokine-inhibiting function of the dendritic cells of the vaginal mucosa, which leads to the atypical weak inflammatory

response. Moreover, BV-associated bacteria *Megasphaera elsdenii* and *Prevotella timonensis* induce dendritic cell maturation and increase proinflammatory cytokine levels [21]. *Prevotella timonensis* causes the immune response development mainly by the cellular type, as it promotes the differentiation of type 1 T-helpers (Th1). *Prevotella* also activates the type 2 Toll-like receptor, which leads to the production of Th17-polarized cytokines by antigen-presenting cells, including IL-23 and IL-1, and also stimulates the recruitment of neutrophils [22, 363–374].

Thus, the BV-associated microflora affects the cytokine-producing function of dendritic cells through the NF-κB signaling pathway and lymphocyte recruitment due to activation of pro-inflammatory cytokine products [23, 965–76]. On the other hand, *in vitro* studies have shown that pro-inflammatory cytokines in high concentrations characteristic of BV stimulate the growth of opportunistic microorganisms [24, 75–78].

All these facts explained the presence of a significant relationship of the three-factor model participants for dysbiosis development risk predicting according to NBI (IL2, IL4, and TNFα). It should be noted that almost all of these properties, to one degree or another, were inherent in other indicators of the immune system during the vaginal dysbiosis development. Moreover, it is obvious that, as prognostic indicators, one could expect the involvement of effector factors of colonial vaginal resistance, which directly bind or destroy bacterial antigens – lysozyme, complement components, sIgA, LPA, CD8 +, CD16 +, and others that took part in this research (see Table 1). The establishment of individual cytokines as prognostic factors to a certain extent is an unexpected fact.

From our point of view, this situation is explained by the formation of a pathological hormonal-immune system, which is formed under the conditions of vaginal dysbiosis progression and supports its development. That is why the "interleukin cascade" indicators, which objectively reflect regulatory violations, come to the fore, and BV, accordingly, can be considered as a dysregulatory pathology. It is a violation of regulatory systems that causes the progression of dysbiosis and its transition to BV.

In this regard, one can give the study results [25], in which the concept of the role of axis functioning disorder of the hormonal-microbiome-immune system in BV was formulated. According to the facts established by us, the reflection of such violations revealed cytokine factors – the content in the blood of IL2, IL4 and TNFα.

Conclusions

1. By applying the neural network analysis using the genetic ALT algorithm, three factors that are most associated with the risk of dysbiosis were selected: blood levels of IL2, IL4 and TNFα.

2. The risk of dysbiosis development due to NBI was statistically significant (p = 0.002) increased with the increase in blood IL2 content (OR = 1.22; 95% VI 1.08–1.39, per unit; ng / ml). The increase (p = 0.001) in the risk of dysbiosis development according to NBI was also established with the increase in the level of TNFα in the blood (OR = 1.11; 95% VI 1.04–1.18, per unit; ng/ml).

3. With the dysbiosis development, a pathological regulatory hormonal-immune system is formed, which contributes to its progression. In accordance with this, BV can be considered as a dysregulatory pathology, and the revealed "interleukin cascade" indicators are its markers.

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EXPERIMENTAL EVALUATION OF THE IMMUNOTROPIC EFFECT OF THE POLYPRENOLS FROM *VITIS VINIFERA*

Abstract. A method for isolation of polyprenols from leaves of *Vitis vinifera* is considered. Their immunomodulatory effect was revealed. It was shown that stimulation of immune responses is observed not only in intact animals, but also in animals with secondary immunodeficiency states, developing in acute toxic hepatitis and radiation exposure. The activity of the polyprenols from *Vitis vinifera* was not inferior to the known immunomodulating agent immunale.

Keywords: polyprenols, *Vitis vinifera*, immunomodulatory effect, secondary immunodeficiency.

Polyprenols are unsaturated acyclic branched alcohols with a primary hydroxyl group in the terminal isoprene residue. The quantity and geometric configuration of these residues varies depending on the plant family [1]. Polyprenols have the ability to stimulate regenerative processes in the body in its various pathological conditions, many of which are accompanied by the development of secondary immune deficiencies [2–4]. In this regard, the study of the effect of polyprenols on the immune system seems to be an important aspect of studying their biological effects on the body. This paper presents data on the study of this aspect of polyprenols, isolated from the leaves of *Vitis vinifera*.

Plant material. Leaves of grapes *Vitis vinifera* L. subsp. *silvestris* was collected in the vicinity of the Tashkent region in August 2017 and dried in the shade at the temperature 20–22 °C [5]. Isolation of the extractive amounts was performed as described in Zokirova et al. [5].

Isolation of polyprenols. Alcohol extract in an amount of 50 g was separated into fractions by column chromatography. The diameter of the column is 30 × 135 cm; silica gel KCK 100/250 mesh, the ratio of adsorbent to extract 40:1, eluent hexane:

chloroform with a gradual increase of polarity of the eluent. 200 fractions of 25 ml were collected. Fractions 120–157 contained 10 g of polyprenols with a content of 60.4%.

Chromatographic purification of polyprenols. This was performed as described in [6]. The yield of polyprenolsis 5.12 g (2.56% of air-dry mass) with a content 97.8%. Polyprenols of *V. vinifera* leaves were identified using IR-, ^{1}H and ^{13}C NMR spectra, as well as ESI–MS. The homologous composition of polyprenols was determined as described in Mamatkulova et al. (2014).

ESI–MS: $C_{50}H_{82}O$ –721 (M+nNa); $C_{55}H_{90}O$ – –789 (M+nNa); $C_{60}H_{98}O$, 857 (M+ nNa). The spectral characteristics of the isolated polyprenols correspond to published data [5; 8].
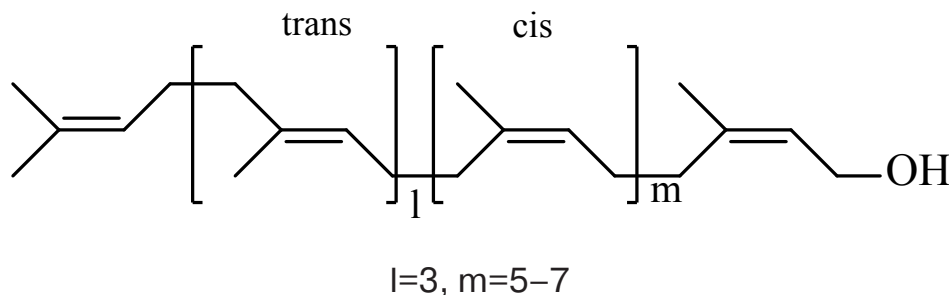

l=3, m=5–7

Figure 1. The structure of polyprenols, isolated from the leaves of *Vitus vinifera*

The experiments were carried out on white mongrel mice with the weight of 21–22 g – intact and with developed secondary immunodeficiency conditions on the background of acute toxic hepatitis and radiation exposure. Acute toxic hepatitis was caused by subcutaneous injection of carbon tetrachloride (CCl_4) in the form of a 20% oil solution of 0.2 ml per mouse for 3 days. Total radiation was performed on Y-medical irradiator of Theratron at a dose of 5 Hz with a power of 1.2 Hz per minute (irradiation time of 20 minutes). The distance from the tube to the surface of the body of the mice is 65 cm, the radiation source is ^{60}Co. In the first case, the animals were immunized with a thymus-dependent antigen – sheep erythrocytes (intraperitoneally at a dose of $2 \times \times 10^7$/mouse) and by introduction of polyprenols (orally at a dose of 25 mg/kg) was carried out on the last day of the administration of the selected toxicant, and in the second, sheep and polyprenol erythrocytes were administered by the same way, by incident after 5 days, after irradiation, in both cases, mice were taken on the 5th day after administration of the test substance and antigenic stimulus. The effect of estimation of polyprenols on the immunological status of the organism was assessed by determining the number of antibody-forming cells in the spleen [9] and counting the total number of cells in the central (thymus, medulla – used the femoral) and in the peripheral (spleen, mesenteric lymph nodes) organs of immunity [10]. So, the effect of polyprenols on the content of erythrocytes and leucocytes in peripheral blood was also considered [11]. All experiments were carried out in comparison with a drug – a stimulator of immune processes in organism – an immune company – of the manufacturer Lek L. L. (Slovenia). Immune was administered according to the same schedule as polyprenolysis of *V. vinifera* at a dose of 50 mg/kg. The obtained experimental material was subjected to statistical processing using t-student criterion.

All obtained data during the experiments clearly indicate that polyprenols isolated from *Vitis vinifera* has an immune stimulating effect. Thus, their introduction to intact mice markedly stimulated the process of primary antibody formation, increasing the number of antibody-forming cells secreting IgM in the spleen in response to immunization with sheep erythrocytes. From Table 1, it is seen that if 4133 ± ± 147 antibody-forming cells are formed in the spleens of normal.

Table 1. – Effect of polyprenols from *Vitis vinifera* on the immunale response to sheep erythrocytes in normal, as well as with secondary immune deficiencies developing against the background of acute toxic hepatitis and radiation of animals. (M ±m, n=6)

Experimental conditions	Number of antibody-forming cells per		Number of cells x 10^6			
	whole spleen	10^6 cells	Thymus	Medulla	Spleen (nucleated)	Lymph nodes
Intimate animals	4133± 147	27.4± 1.2	27.8± 2.7	10.2± 1.2	151.6± 6.1	19.2± 0.70
Polyprenols from *Vitis vinifera*	7416±541*	37.6±3.5*	45.3±1.2*[,2]	18.3±0.8*[,2]	199.7±8.8*[,2]	32.8±1.7*[,2]
Immunale	6516±712*	36.8±2.7*	38.0±1.5*	14.8±1.3*	175.0±5.0*	24.8±0.9*
CCl_4^- hepatitis (the control I)	558.7±17.4*	6.7±0.4*	13.5±0.8*	6.0±0.6*	83.8±3.0*	9.2±1.05*
CCl_4^- hepatitis + Polyprenols	2288±147*[,1,2]	16.1±0.9*[,1,2]	23.2±1.7[1]	9.3±0.8[1]	143.0±10.2[1]	15.2±1.2*[,1]
CCl_4^- immunale	1535±127*[,1]	12.7±1.2*[,1]	18.2±1.7*[,1]	8.3±0.5[1]	123.0±6.2*[,1]	12.8±0.9*[,1]
Irradiation (control II)	107.0±4.6*	2.6±0.1*	7.0±0.9*	4.5±0.4*	41.5±1.8*	3.8±0.6*
Irradiation + Polyprenols	507.0±21.7*[,1,2]	5.2±0.3*[,1,2]	15.3±0.9*[,1,2]	8.6±0.5[1,2]	97.5±2.7*[,1,2]	9.5±0.4*[,1,2]
Irradiation + Immunale	288.3±18.7*[,1]	3.7±0.2*[,1]	12.5±0.6*[,1]	7.0±0.3*[,1]	78.0±3.4*[,1]	8.0±0.0*[,1]

Reliable to indicators of intact animals,[1]– to appropriate control

[2]– *Significance of values between groups of animals treated with polyprenols and immune (p<0,05)*

From Table 1, it is seen that if 4133±147 antibody-forming cells are formed in the spleens of normal mice of this series of experiments, it can be seen that if 4133±147 antibody-forming cells are formed in the spleens of normal mice of this series of experiments, then the administration of the studied polyprenols to animals led to an increase in the immune response to sheep erythrocytes by 79.4%. This increase was noticeable, and under calculating the number of antibody-forming cells to per 1 million splenocytes (normally there were 27.4±1.2, in the experiment 37.6±3.5). Under the influence of polyprenolysis of *V. vinifera*, it was occurred an increase of cellularity of the central and peripheral organs of immunity.

The number of cells of the thymus, medulla (bone marrow), spleen (nucleated), mesenteric lymph nodes increased by 62.9, 79.4, 31.7 and 70.8% (Table 1). In addition, a certain stimulation of polyprenolaminerythro – and leucopoiesis was also noted (Table 2). An important point in the study of polyprenols as an immune tropic agent was the identification of their pronounced immune stimulating effect in the conditions of developing secondary immune deficiency states in which serious violations in the immunological reactivity of the organism are observed.

In the (Table 1), it was showed that under the conditions of development of acute toxic hepatitis and, especially when animals were irradiated, the amount of antibody-forming cells in the spleen of mice decreased by 86.5 and 97.4%, the number of nucleated cells of the spleen decreased by 44.7 and 72.6% (under recalculated the number of antibody-forming cells per 1 million splenocytes, their decreases were 75.5 and 90.5%). Deep changes were noted

in the total thymus cellularity decreased by 51.4%, with irradiation by 74.8%. As for medulla cells, this decrease was 41.2–55.9%, and lymph nodes – 52.1–80.2%, respectively. Significant negative changes were detected in the content of erythrocytes in the blood (decrease by 22.4–58.2%) and leukocytes – by 29.3–56.0%. Under these conditions, polyprenols from *V. vinifera* showed a pronounced tendency to restore the considered parameters.

As can be seen from Table 1, the amount of antibody-forming cells increased in relation to the corresponding control in animals with hepatitis by 309.5%, and in irradiated animals – by 373.8% (under converted to 10^6 splenocytes, this increase was

140.3 and 100.0%). The number of thymus cells with hepatitis in relation to the control increased by 34.8%, and under irradiated by 118.6%. For the medulla, this increase in both cases was 55.0 and 91.1%. The number of nucleated cells of the spleen, it was increased by 70.6 and 134.9%, the cellularity of the lymph nodes, it involves by 65.2 and 150.0% (Table 1).

Table 2 shows that the administration of the studied polyprenols to mice with hepatitis and exposed radiation also had a restoring effect on the content of erythrocytes (it is higher than the corresponding control to 25.0 and 78.6%) and leukocytes (it is higher than the control to 35.8 and 81.8%).

Table 2. – Effect of polyprenols from *Vitis vinifera* on the immunale system showed the content of erythrocytes and leucocytes in the blood of mice immunized with ram erythrocytes and normal secondary immune deficiencies in acute toxic hepatitis and animal irradiation. (M ±m, n=6)

Experiment Conditions	Erythrocytes x 10^9/ml	Leucocytes x 10^6/ml
Intimate animals	6.7± 0.5	7.5± 0.4
Polyprenols from *Vitis vinifera*	8.8± 0.4*	9.8± 0.3*
Immunale	8.2± 0.3*	9.3± 0.2*
CCl_4- hepatitis (control 1)	5.2± 0.3*	5.3± 0.2*
CCl_4^-+ polyprenols	6.5± 0.3[1]	7.2± 0.3[1]
CCl_4+immunale	6.3± 0.2[1]	6.7± 0.4[1]
Irradiation (control II)	2.8± 0.3*	4.3± 0.3*
Irradiation + Polyprenols	5.0± 0.4[*,1]	6.0± 0.4[*,1]
Irradiation + Immunale	4.3± 0.2[*,1]	5.2± 0.3[*,1]

Reliability to indicators of intact animals,[1] to appropriate control (p<0.05)

In all performed experiments, the effect of polyprenols from Vitis vinifera leaves, how to immunogenesis, and hematological indicators had a certain similarity with the action of the immunale, but it is manifested in a slightly more pronounced degree (Tables 1, 2).

Thus, polyprenols from the leaves of *V. vinifera* can be attributed to immune active drugs that have a rather pronounced effect in this respect, which is manifested not only in the norm, but also, which is especially important, in modeling secondary immune deficiency states. In addition, it should be noted that the detected stimulating effect of polyprenols on immune processes, apparently, can be of great interest not only from the position of eliminating their imbalance in pathological processes, but also in plans of increasing while the general non-specific resistance of the organism [12].

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Section 5. Pedagogy

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MAIN ASPECTS OF FORMATION OF LEGAL CULTURE OF STUDENTS OF PEDAGOGICAL UNIVERSITIES

Abstract. From the first days of its independence, the Republic of Uzbekistan has been committed to the harmonious development of the younger generation, independent thinking and responsibility, as well as respect for national independence, deep respect for national values, patriotic upbringing, physical and mental health were carried out a number of structural works. At the same time, a legal framework was created to ensure the protection of rights and legitimate interests. A crucial role in this is played the modern education system, which is aimed at forming a political, economic and legal culture of the individual, its active social, civic position, human dignity and responsibility for actions.

Keywords: Legal culture, social activity, civic maturity, intelligence, communication culture, tolerance, sociability, legal, ethical and aesthetic culture.

Having heard and discussed information of the Minister of higher and secondary special education of the Republic of Uzbekistan and the Minister of national education of the Republic of Uzbekistan on the activities of educational institutions among the population, particularly the youth, high legal culture, respect for rights and freedoms, ensuring law-abiding behavior of citizens, the Council of the Senate of the Oliy Majlis of the Republic of Uzbekistan notes that in this direction some works were done [1].

Modern conditions of professional activity of higher education institutions require not only high-quality training of specialists, but also a high level of socialization, spiritual and moral personality traits, such as social activity, civic maturity, intelligence, communication culture, tolerance, sociability, legal, ethical and aesthetic culture. Educational practice needs new ideas for integrating the formation of citizenship and legal culture of students in teaching activities, and practical recommendations for their creative use in the educational process of higher education institutions.

A number of gradual reforms have been implemented during the independence period to increase the legal literacy of young people. As noted above, a number of laws and regulations have been enacted to increase the legal literacy of young people. These include the Law on State Youth Policy, the National Program of the Oliy Majlis of the Republic of Uzbekistan on raising legal culture in society, the President of the Republic of Uzbekistan on Improving the Effectiveness of State Youth Policy and the activi-

ties of the Youth Union of Uzbekistan, Decrees "On support" and "On the organization of the study of the Constitution of the Republic of Uzbekistan", the Cabinet of Ministers "On a comprehensive program to improve the legal education of youth" Resolution etc. were stated [1].

Legal culture is a part of society's culture. It mediates all the main spheres of legal life of society: legislation, law-making, the rights and freedoms of citizens, the mechanism of the state, the principles and methods of its activities, legal awareness in all its types and levels, and, thus, is an important criterion for the quality of legal life of society, which can be expressed by the concept of legal culture. This is the level and degree of progressive legal achievements embodied in human activity and its results. Legal culture determines the measure of legal civilization of the state and society, their legal progress. This is an indicator of the height of the legal consciousness of society, it characterizes the most important cultural and legal values that serve as a kind of " pass " to the family of civilized people of the world.

The state of legal culture of any state is an important indicator of the degree of maturity of a specific historical legal system. The level of legal culture reflects the historical development of the country and people. Therefore, each country has its own level, it combines the norms of yesterday and today, and at the same time lays the Foundation for tomorrow's development of law. In its legal system, as in a mirror, the level of progressive legal development of society achieved at the turn of centuries and millennia are reflected [4].

The aim of the citizens of the Republic of Uzbekistan is free, democratic and to build a humane legal state and society. It's about building a community further tasks of organizing a new social civic education in the process complicates. So far, the building of a democratic, legal society success is the level of socio-political consciousness of citizens, citizenship depends on the determination of their qualities and indicators of social activity. The social basis of

citizenship is a new socio-economic relationship, in which the personal interests of the citizens are combined with the interests of society.

People's ideas about legal culture are as diverse and complex as general ideas about what culture is in general and how to understand it when considering the various manifestations of this phenomenon in real life.

The concept of culture is a complex, multi-faceted and very peculiar phenomenon. The word culture comes from the Latin "cultura" and means the cultivation of the soil, its cultivation, i.e. the change in a natural object under the influence of man in contrast to those changes that are caused by natural causes [5]. The word "culture", which appeared in the period of antiquity, has undergone many conceptual reinterpretations. In the original meaning-cultivation, guardianship, care, first in relation to the earth, objects, and then to the souls of men. Over time, the concept also includes a set of skills and abilities that have been formed in society for the chosen purpose; finally, it acquires the meaning of the highest result of people's activities. Gradually, its leading meaning becomes to cultivate, care for, protect the person and society, to form the moral image of the individual.

Culture is a specific human way of being and activity that goes beyond the scope of purely natural existence, the totality of all the achievements of people in their material, social and spiritual life, the most rational, aesthetically acceptable and morally worthy way of acting to obtain any results. Culture is based on reason, speech, creativity, moral and religious beliefs and their consequences – knowledge, practical life and communication. It is not created alone – it is the result of the creative efforts of many people and the connection of generations. They distinguish between cultures of different historical epochs, socio-economic formations, labor culture, artistic culture, political culture, etc.

N. Kogan defines culture as a measure and a way to realize the essential forces of a person in his social activity. Such well-known cultural theorists

as V. Vernadskiy, N. Berdyaev, I. Ilyin, V. Rozanov consider culture as a set of real circumstances, phenomena, objects, lifestyle and activities that have distinguished a person from the natural environment; this is all that is created by human hands and thought (the creation of human hands). The most general concept of "culture" means a set of material and spiritual values created and created by people, a set of all types of transformative activities for the production of these values that characterize the level of development of society [6].

In the broadest sense, culture refers to everything that is created by people in the process of physical and mental labor to meet their various material and spiritual needs (and that can be contrasted with natural phenomena that exist independently of man). In this context, this concept is used to characterize entire historical epochs, not to mention specific societies. The formation of a legal culture of an individual as a scientific problem has several approaches:

– general philosophical, revealing the General patterns of formation of the culture of the individual, its essence and manifestations;

– private scientific, describing on the basis of private scientific theories (pedagogy, didactics, psychology, theory of state and law, ethics, etc.) the features of the formation of personal culture;

– socio-psychological and specifically-sociological, revealing the social functions, conditions and mechanisms of action of the culture of the individual in public life.

Each of these approaches sets and solves specific tasks and is studied by means of a specific social science [7].

A productive solution to the problems of students ' culture formation is possible based on the analysis of the experience of educational and organizational work, generalization of the conclusions of theoretical and sociological research at the intersection of higher school pedagogy, theory of personality and culture. The works of Yu. P. Azarov, SI. Archangelsky, A. A. Verbitsky, I. F. Isaev, V. A. Slastenin, M. I. Dy-

achenko, E. F. Sulimov, E. A. Yakuba and others have created a solid theoretical and practical base for solving the actual problems of forming culture and improving the quality of training of specialists. In a number of dissertation studies, scientific and methodological and psychological and pedagogical bases for the formation of legal culture of youth (T. V. Budilina, E. A. Zorchenko, V. V. Golovchenko, V. N. Parshin, E. Z. and others) were developed.

At the same time, analyzing the current practice in the system of higher professional non-legal education, we can conclude that, despite the understanding of the importance of the problem, the technology of the formation process, the study of the formation of the legal culture of students of non-legal specialties is not sufficiently developed.

In our article, we have made an attempt to analyze and summarize the available research on this topic and offer our own vision of the problem of the process of forming the legal culture of students.

Legal culture is based on the stereotypes of consciousness and legal behavior inherent in this particular social community. Legal stereotypes are formed in the mass consciousness in the process of historical development of society. It should be noted that it is impossible to quickly and painlessly move from a society where law and legal culture were given too little space, to a society where law occupies its proper place, and citizens would have a high legal culture. The formation of a legal culture is a complex and lengthy process: it involves increasing the level of legal awareness, legal activity, and legal knowledge of citizens, improving the effectiveness of law enforcement, conducting judicial reform, and improving the culture of law enforcement and law-making, as well as the quality of legislation. Legal culture is formed by systematic purposeful educational and educational activities of the state and depends primarily on the level of development of legal consciousness of citizens, on how deeply they are aware of the basic legal values.

The ordinary level is limited by the everyday framework of people's lives when they come into contact

with legal phenomena. The specificity of everyday legal culture is such that it manifests itself at the stage of common sense, is actively used by people in their daily life while observing legal obligations, using subjective rights, and represents a huge array of lawful behavior.

The highest goal of education is to form a highly moral, creative, competent citizen who accepts the fate of the motherland as his own, who is aware of responsibility for the present and future of his country, and who is rooted in the " spiritual and cultural traditions.

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Section 6. Psychology

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VALIDATION OF BERGEN FACEBOOK ADDICTION SCALE AMONG NIGERIAN UNIVERSITY UNDERGRADUATES

Abstract

Background: Research studies show a high penetration rate of Facebook usage among Nigerian most of which are compulsive. The Bergen Facebook Addiction Scale (BFAS) had been validated in many languages and is used in many countries but not yet in Nigeria. This study validates BFAS to determine psychometric properties acceptable for Nigerian population.

Method: **A total of 864** (*mean age 20.5*) undergraduates purposively selected from two state-owned and two privately owned Universities in Osun state southwestern Nigeria made up of 352 male and 512 females, participated in the study. Participants responded to Bergen Facebook Addiction Scale (BFAS), Internet Addiction Test (IAT), and Smartphone Addiction Scale- Short Version (SAS-SV).

Results: Determined new norm for the six factors of BFAS for both male and female ranged from ≥ 42.3 (relapse) to ≥ 50.5 (mood modification). Internal consistency showed a Cronbach's coefficient of .90, a Spearman-Brown coefficient of .83 and Guttman Split-Half coefficient of .83. All items in the scale reported acceptable goodness-of-fit measures revealing corrected item-total correlations range of .88 to .90. All the factors of BFAS had acceptable Cronbach standardized alpha ranging from salience .73, to mood modification .81. Significant positive correlation was observed between the scales revealing concurrent validity scores of r = .558, *p*= .000 between BFAS and SAS-SV and r = .508, *p* = .000 between BFAS and IAT.

Conclusion: BFAS is none gender sensitive and has acceptable psychometric properties for Nigerian population.

Keywords: Validation, Facebook Addiction, undergraduates, Nigeria.

Introduction

According to Global Digital Report [1] the number of social media users worldwide in 2018 is 3.196 billion. The global social network penetration as at January 2018 stood at 42%, with West Africa having 11% social network penetration [2]. The demand for social network sites across the globe is huge and still growing. By the fourth quarter of 2016 Facebook was the first social network site to surpass 1 billion registered accounts and in a ranking by number of active users in October 2018 by Statista [2] is the most famous social network sites worldwide recording 2.23 billion monthly active users. In the third quarter of 2017 Nigeria reported a 41 percent penetration rate in Facebook usage [2], and by January 2018 Nigeria annual growth rate of social media users stood at 6% [1].

Andreassen & Pallesen, [3] defined social networking addiction as "being overly concerned about Social Networking Sites (SNSs), driven by a strong motivation to log on and use SNSs and a devotion of so much time and effort to SNSs that it impairs other social activities, studies/job, interpersonal relationships, and/or psychological health and well-being". Over the years scholars have studied the use and addiction of Facebook and its effect on human behavior. The Bergen Facebook Addiction Scale (BFAS) was developed by Andreassen, Torsheim, Brunborg, and Pallesen, [4]. It is an eighteen -item scale with six factors. Being built

on the on general theory of addiction, BFAS in the opinion of Griffiths, Kuss, & Demetrovics, [5] is possibly the most accurate instrument for measuring Facebook addiction to date [6].

In line with the addiction theories, BFAS measures symptoms as salience (being preoccupied with social networking), tolerance (spending more time social networking in order to feel satisfied), mood modification (using social networking sites to feel better), conflict (social networking over most other important life aspects), withdrawal (experiencing withdrawal symptoms when prohibited from social networking), problems (social networking cause some kind of harm), and relapse (finding it difficult controlling or stopping the social networking behavior) [6; 7; 8].

According to APA [9] the items of BFAS is worded following the format of formal diagnostic addiction criteria, is brief, has recommended scores and possess adequate acceptable psychometric properties [3, 4]. Mobile technologies such as the smartphones and other mobile and devices have aided the rise of Facebook and other social networking addictions [3]; despite this trend there is no formal diagnosis of social networking addiction in any psychiatric nosology [7; 8]. Reported prevalence of Facebook addiction ranges between 1.6% [10] and 8.6% [11].

Bergen Facebook Addiction Scale has been validated in many languages including Thai [12], Turkish [13], Spanish [14], Portuguese [15], Bangla [16]

and Arabic using Egyptian samples [17]. However to the best of authors' knowledge, no validation study has been carried out on Nigerian sample. The focus of this study is, therefore, to validate the BFAS and obtain new norms and acceptable psychometric properties using a Nigerian population.

Materials and Methods

Participants

A cross sectional survey design was employed in the study. The population comprised of University undergraduates from two State-owned and two privately owned Universities in Osun state southwestern Nigeria. A random sampling technique was used to select the four universities in Osun state and four faculties in the universities, while a purposive sampling technique was adopted to select participants across the faculties, programmes, levels of study and gender. A total of 864 undergraduates participated in the study.

Measurements

The Bergen Facebook Addiction Scale (BFAS) [4] comprised a pool of 18 items, three for each of the six factors measuring symptoms of addiction [6]: salience, mood modification, tolerance, withdrawal, conflict, and relapse. Each item is rated on a 5-point scale using anchors of 1=very rarely, 2 = rarely, 3=sometimes, 4= often, 5=very often. Total score ranged from 6–30. Higher scores indicated higher level of addiction. The scale is concerned with experiences during the past one year related to Facebook use. The items are constructed in line with diagnostic criteria for pathological gambling [9] and the Game Addiction Scale [18]. Then, the item with the highest corrected item-total correlation from within each of the six addiction components was retained in the final six-item scale.

Existing Psychometric Properties of BFAS

The Cronbach's Alpha of this measure in the original study by Andreassen et al., [4] was 0.83. Item-total correlations were ranged from 0.60 to 0.73 and the test-retest reliability was 0.82 as reported by authors. This measure was highly correlated with the Addictive Tendencies Scale [19] and the Face-

book Attitude Scale [20]. Salem et.al [17] reported a Cronbach's coefficient of 0.88 among Egyptian, while Ahmed and Hossain [16] returned item-total correlation of each factor ranging from 0.735 (withdrawal) to 0.791 (salience), and a Cronbachs alpha coefficient of 0.91 among Bangladesh population.

Statistical Analysis

Descriptive statistics including mean and standard deviation were used to determine the new norms for the instrument while mean scores for gender was employed to determine the gender sensitivity of the norms.

To determine the internal consistency / reliability of BFAS, Cronbach's alpha, Spearman-Brown coefficient and Guttman Split-Half coefficient was calculated and obtained to determine the extent to which items in BFAS were interrelated. To determine the concurrent validity Pearson Moment Correlation Analysis was used to correlate BFAS with Internet Addiction Test (IAT) by Young [21] and Smartphone Addiction Scale-Short Version (SAS-SV) by Kwon, Lee, Won, Park, Min, and Hahn [22]. The items-total correlations were also obtained to test the relationship between each item and the composite / total item score.

Results

Demographic characteristics of the participants show that 352 (40%) were male while 512 (60%) were females. Distribution by age categories showed that 355(41%) were ≤ 19 years while 509(59%) were ≥ 20 years old. The mean (± SD) age of the participants is 20.48 ± 2.82 years. Further results revealed that 205(23.8%) of the participants were from Obafemi Awolowo University, 263(30.4%) were from Osun State University, 217(25.2%) were from Redeemer's University, and 179(20.5%) were students of Bowen University. Overall 414(54.3%) were students of two public owned institutions, while 450(45.7%) were students in private institutions of learning all in Osun state southwestern Nigeria.

Furthermore, participants from Faculty of Natural Sciences were 235(27.4%); 365(42.5%) were

from Faculty of Social Sciences, 131(15.0%) from Faculty of Humanities / Education and 133(15.1%) were from the Faculty of Law. Finally, 197(22.9%) of the participants were in the first year of study; 211(24.5%) in the second year of study, 171(19.7%) were in the third year of study and 285(32.9%) in the final year of study in the selected universities.

Calculation of Norms of BFAS

Table 1. – Norm for both male and female adolescents

	N = 864
Factors of BFAS	**Norms**
Salience	≥ 44.8
Tolerance	≥ 45.7
Mood modification	≥ 50.5
Relapse	≥ 42.3
Withdrawal	≥ 45.9
Conflict	≥ 44.0
BFAS	≥ 49.2

The cut off value (norm) of the factors and composite BFAS for both male and female Nigerian adolescents is summarized in (Table 1). By implication, any score above the norm is considered to be Facebook addiction. This cut off result shows that among Nigerian population BFAS is not gender sensitive.

Measure of Reliability of BFAS

In other to determine the reliability and verify the internal consistency of the items on Nigerian population, Cronbach's alpha (or alpha coefficient), Spearman-Brown coefficient and Guttman Split-Half coefficient were used. As summarized in (Table 2), the internal consistency, measured by Cronbach's coefficient was ($\alpha = 0.90$), with a Spearman-Brown coefficient of .83 and Guttman Split-Half coefficient of 0.83. Corrected item total correlations range from 0.88 to 0.90. The result of this analysis shows that BFAS is reliable for the Nigerian population. All items in the scale resulted in acceptable goodness-of-fit measures.

Table 2. – Correlation Coefficients of Scale Items

				N = 864	
S/N	**Item**	**Item mean**	**SD**	**Corrected item/total**	**Cronbach's alpha if item is deleted**
1	*2*	*3*	*4*	*5*	*6*
Item 1	Spent a lot of time thinking about Facebook or planned use of Facebook?	2.50	1.27	0.640**	0.90
Item 2	Thought about how you could free more time to spend on Facebook?	2.56	1.21	687**	0.90
Item 3	Thought a lot about what has happened on Facebook recently?	2.59	1.19	701**	0.90
Item 4	Spent more time on Facebook than initially intended?	2.84	1.22	701**	0.90
Item 5	Felt an urge to use Facebook more and more?	2.79	1.25	667**	0.90
Item 6	Felt that you had to use Facebook more and more in order to get the same pleasure from it?	2.69	1.20	726**	0.90

1	2	3	4	5	6
Item 7	Used Facebook in order to forget about personal problems?	2.87	1.25	687**	0.90
Item 8	Used Facebook to reduce feelings of guilt, anxiety, helplessness, and depression?	2.76	1.20	700**	0.90
Item 9	Used Facebook in order to reduce restlessness?	2.78	1.19	714**	0.90
Item 10	Experienced that others have told you to reduce your use of Facebook but not listened to them?	2.61	1.23	693**	0.90
Item 11	Tried to cut down on the use of Facebook without success?	2.68	1.22	718**	0.90
Item 12	Decided to use Facebook less frequently, but not managed to do so?	2.73	1.19	736**	0.90
Item 13	Become restless or troubled if you have been prohibited from using Facebook?	2.70	1.27	767**	0.89
Item 14	Become irritable if you have been prohibited from using Facebook?	2.67	1.21	707**	0.88
Item 15	Felt bad if you, for different reasons, could not log on to Social media /Smartphone Apps for some time?	2.77	1.23	740**	0.88
Item 16	Used Facebook so much that it has had a negative impact on your job/studies?	2.50	1.20	720**	0.88
Item 17	Given less priority to hobbies, leisure activities, and exercise because of Facebook?	2.73	1.23	679**	0.89
Item 18	Ignored your partner, family members, or friends because of Facebook?	2.65	1.28	662**	0.90

Table 3. – Pearson's correlation of factors and composite BFAS

		N =864	
	Mean	Standard deviation	Factor- total correlation
1	2	3	4
Salience	7.43	3.08	0.641**

1	2	3	4
Tolerance	8.04	3.14	0.651**
Mood modification	8.19	3.13	0.649**
Relapse	7.71	3.08	0.674**
Withdrawal	7.91	3.20	0.666**
Conflict	7.81	3.24	0.601**

Table 3 reveals that each of the factors in the scale has significant positive correlation with the composite score of BFAS.

Cronbach's alpha was also used to measure the unidimensionality and homogeneity of the factors of BFAS. The observed Cronbach's α are: Salience α = 0.73, Tolerance α = 0.76, Mood modification α =0.81, Relapse α = 0.76, Withdrawal α =0.79 and Conflict α =.80. Each of the factors of BFAS has good and adequate internal consistency.

Measure of Validity of BFAS:

To measure the validity of BFAS, concurrent validity was employed to show how well BFAS compares to two other well established related tests. Using the Pearson's r, correlations between Bergen Facebook Addiction Scale (BFAS), Smartphone Addiction Scale – Short Version (SAS-SV) [22] and Internet Addiction Test (IAT) [23] were investigated. As summarized in (Table 4), BFAS correlated positively and significantly with SAS-SV and IAT. The correlations coefficient between ratings on BFAS and SAS-SV (r = .558, p= 0.000) was statistically significantly higher than between BFAS and IAT (r = 0.508, p = 0.000). This result shows that BFAS is valid for Nigerian population.

Table 4. – Pearson's correlation of BFAS, SAS-SV and IAT

		(N=864)	
	SAS-SV	**IAT**	
BFAS	0.558**	0.508**	

** Significant at p = 0.000

Discussions

This validation study used Adolescent population, drawing from reports that they have a tendency of high level concentration when using social media than do adults; an action which can result into addiction [24]. Moreover adolescents are more vulnerable to internet and smartphone addiction than do adults [22; 24]. The BFAS cut off score was same for both male and female adolescents hence not found to be gender sensitive among Nigerian adolescents. In an earlier study Wong, Tho and Sin [25] found no significant gender difference in smartphone addiction among Malaysian undergraduates. This is also in tandem with reports of none gender sensitivity on Facebook addiction by Casas, Ruiz-Olivares and Ottega-Ruiz, [26] and smartphone addiction by Kwon et al., [22].

The BFAS in the Nigerian version reported a Cronbach alpha of 0.90, and item-total correlation ranging from 0.88 to 0.90. These are higher scores than the original Cronbach alphas of .83 and item-total correlation range of between 0.60 and .73 obtained by the author among Norwegian students [4], and Salem et.al [17] reported Cronbach's coefficient of .88 among an Egyptian sample. The implication of our finding shows a good inter-relatedness of the items of the BFAS, unidimensionality and homogeneity of the construct [27; 28] among the Nigerian population. The alpha scores are also not too high to render some items redundant as the alpha values did not exceed the maximum value of 0.90 [29; 30]. In summary the high alpha score in our study shows that BFAS has a strong reliability value.

Conclusions and Recommendations

Based on the findings of this study we conclude that BFAS has acceptable psychometric properties for Nigerian population. BFAS is not gender sensi-

tive and has new norms for the six factors as well as composite score among Nigerian populations. Accordingly, it can be said that BFAS fits well to the Nigerian socio-cultural setting as a measure of Facebook addiction. Further validation studies using a larger sample, as well as other geopolitical regions of Nigeria are recommended.

Ethical Considerations

This study carried out investigations that involved human elements hence ethics of research for human subjects were observed. The researcher reviewed online regulatory and informational documents on human-subject protection and passed the examination on responsible conduct of human studies and was issued a Certificate for Bioethics and Research by the Nigerian National Code of Health Research Ethics. Moreover, the research intention and proposed procedures for carrying the research was subjected to scrutiny by the Internal Research Ethic Committee (IREC) of Redeemer's University, Ede, Osun State southwestern Nigeria. Also the approval of research committees of Osun State University, and Bowen University was obtained before the research was embarked upon. Judging that the average age of respondents was eighteen years and therefore can make decisions of this magnitude for themselves, they were approached individually and explanation of what the study is all about was made to them and their willingness to participate was obtained. Thus participant's informed consent was obtained before the instruments were administered.

Conflict of interest

The authors declare that there is no conflict of interest.

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POLYMODALITY OF REFLECTION: TRIANGULAR RELATIONS BETWEEN MODALITIES

Abstract. Reflection is the object of various sciences's researches: philosophy, linguistics, logic and psychology. In the psychology of reflection, researches were divided into forms, types, means, mechanisms, processes and substrates. The study of the integrity of reflection is a new direction. A modal understanding of reflection reveals it whole. We applied a modal analysis, included the principle of triangulation in it. As a result, we received two rows of a triangular network of modalities. We conducted testing using the Focus Reflection test on a sample of 807 people (261 men, 546 women) aged 18 to 64 years. By correlation and factor analysis, we have confirmed the triangular relationship between reflection modalities. The first row is formed by relations of ontic modalities: the real, the possible, the necessary, and their opposites. The second row is derived from the first. Six kinds of relations of the first row modalities are formed by twelve modalities of the second row. These series has several features: negative forms of relationship types that produce some modalities are positive forms of relationship types that form other modalities; three factors reveal the interconnectedness of modalities – conscious and temporal; transgredient and multidimensional; sufficient and transcendental; as well as their opposites.

Keywords: reflection; modality; triangular network; integrity.

1. Introduction

The use of the word "reflection" in scientific psychological literature since the inception of psychology has undergone various changes from the replacement, at first glance, by seeming equivalents to the modern understanding of the presence of reflection in everything that relates to a person's mental life – consciousness, behavior, interaction with other people, activities, personality and more. Introspection, self-reflection (human thoughts about himself), reflective (used in the works of J. Piaget), psychological mindedness, self-awareness, in theory of mind (understanding the possibility of erroneous opinions, the ability to present a situation from different points of view, intuitive understanding of one's and other's mental states, such as thoughts and opinions), consciousness, metacognitive knowledge and metacognitive control (experience), and even simple modern "feedback" used in scientific papers, from simple empirical studies and scientific essays to fundamental areas of research, for example, the metacognitive approach or the theory of consciousness, have one common characteristic, such as being above something psychic and thereby creating a

new psychic reality that is different from the reality over which all of the above processes are carried out. This "over-" G. P. Shchedrovitsky designated it as a "reflective position" in which, on the basis of certain norms and rules that correspond to culture or personal experience, he creates an idea of what this position is dealing with [27]. Creation of this mental representation or as G.P. called Shchedrovitsky "pictures" and the "picture" itself are reflection. All of the above equivalents to one degree or another reveal one or another aspect of reflection. The rationale for differences in reflection studies are paradigms and approaches [4, 23–25]: phenomenological [2; 7; 12; 21; 22; 35], activity [3; 14; 36], regulatory [31], anthropological [34], cognitive [6], differentiated [13], cultural-historical [20; 36], trans-temporal [15; 16]. We distinguish three reflection values presented in studies. 1) Reflection as an awareness of the nearest state of time [18; 30]–awareness. In this case, reflection acts as a mental state. Such reflection has limitations and is based on current self-observation. 2) Reflection acts as a property of thinking, activity, consciousness, personality. In some studies, the property is replaced by a mechanism without changing the subject area of reflection [13; 18; 31; 32; 36]. It has psychological time and psychological extent of the event. 3) The rapid development of cognitive psychology in the post-non-classical period led to a new meaning of reflection – reflexivity. From the metacognitive approach point of view, reflection is at the same time a property, a process, a state, and belongs to the metasystem level of the psyche [9; 10; 19]. Reflection was considered as a mechanism of self-regulation of metacognitive processes and activities, a mechanism of self-regulation of personality. Introducing the new concept of "reflexivity", proponents of the metacognitive approach essentially continue to consider reflection as a property of thinking. Our task is to single out the integrity of reflection, in which it, as a property, process, condition, mechanism, function, ability and so on, is, in all its diversity, an independent phenomenon of

the psyche that builds relationships with thinking, consciousness, personality, activity. It is these relationships that allow researchers to detect reflection in thinking, consciousness, personality, activity as a process, or mechanism, or property, and so on. But reflection, although it manifests itself in thinking, activity, personality, thinking, but does not belong to any of them. Reflection has an independent status as a phenomenon and therefore it should be studied as a phenomenon different from thinking, consciousness, activity, personality, but at the same time, having relations with them and manifesting itself in them. Such a double essence of reflection – to be an independent phenomenon and to be inside other phenomena, can be investigated from the perspective of a modal-intentional approach. Modality as a category and intentionality as an orientation are those with which we can explore the integrity of reflection, and not its parts in the form of means, mechanisms, process steps, etc., which is the subject of studies of functional-structural-attributive approaches.

Common in research was the understanding that thinking about reality is an event after a fact and is actualized in a problem situation. We distinguish two main stages of the study of reflection: 1) the first stage – the study of reflection within the subject area – thinking, activity, consciousness, personality, imagination and thereby reflection carried the characteristics of the subject area, which led to the emergence of many similar concepts in semantics; 2) the second stage – the study of reflection outside the subject areas, the recognition of its independence as a psychological phenomenon that has its own ontology, structure and performs the same functions for different subject areas. Chronologically, the second stage covers the period from the beginning of the century to the present day. Modern researchers have been given the task of highlighting the integrity of reflection, units of integrity.

We summarized the achievements in the study of reflection in the first stage and created a model – constructor – metamodel of reflection, consisting of

four models of reflection, and then using the fifth model to come to an understanding of integrity – intentionality of reflection [27]. On the other hand, the modal concept of reflection also encompasses holistic reflection. The question of the unity of two types of integrity led to the development of a new model of reflection, which is the unity of polymodality and multi-ethnicity that permeate each other and have inverse relationships [28; 29]. Further research raised the question of the structure of the polymodality of reflection, which would not only be logically justified, but also empirically confirmed.

The key notions of this article are reflection and modality. We consider modality as an integrated unit that carries ontological variable object existence (that is reflection in our case) and its manifestation [4, 16]. In our context, "variability" means changing and internal dynamic transitions from one modality into another one. A. A. Medova poses a question about the way some modalities produce other modalities [17]. We had a try answering this and other questions, connected with reflection modalities. We believe that modalities are expressed in categories [4; 16]. Modal categories allow distinguishing, analyzing and structuring intrinsic features, understanding organizational principles of reflection integral existence. We do not consider modality from the linguistic, logic, perception psychology or any other point of view. We consider philosophical understanding of modality as basis.

Under reflection we understand: the highest level of a soul layer – over consciousness, thinking, personality, activity, which is in relation to them a way of regulation, orientation and research to make choices based on the possibilities, necessity and reality for the purpose of self-organization of organic system's life [27]. Reflection is not considered as reflexivity that is consciousness characteristics or mentality metacognitivistic mechanism. Reflection is considered as an onthological phenomenon, distinguishing its kernel and its integrity.

These foundations determine both general and specific ontology for the reflection.

The study of modalities in psychology is a different theoretical approach, a different psychology, which differs from a functional-structural psychology that decomposes the whole into parts. In this article, we solve the problem of verifying our theoretical concept of the polymodality of reflection, structured on the basis of the principle of triangulation.

2. Materials and Methods

We applied a modal analysis. It included the isolation, justification, and confirmation of the triangular ratios of the known ontic modalities (necessary, possible, real, and their opposites) and new modalities derived from relations between them. The selection is based on the principle of triangulation, which allows us to select series of modalities. The rationale is built on philosophical ideas about known modalities [17] and knowledge of reflection, presented in the research [2–7, 9–16, 19–25, 30–32, 35, 36]. The confirmation is based on results obtained with the help of the psychodiagnostic questionnaire "Focus reflection" [26]. Correlation and factor analysis were performed to confirm the triangular relationship between modalities. Correlations given in the article correspond to the confidence level $p \leq 0.001$. The factor analysis applied the rotation method of varimax with Kaiser normalization.

Psychodiagnostic questionnaire "Focus reflection" is based on the model of the integrity of reflection. On its diagnostic range, there are 13 intentions of reflection and 16 modalities.

The sample size was 807 people (261 men, 546 women) aged 18 to 64 years. The subjects have a different level of education and place of residence in the city of Novosibirsk (Russia).

3. Results

Peculiarities of the first row of reflection modalities, which constituted ontic modalities (the real, the possible, the necessary and their opposites), made it possible to consider reflection as an independent general psychological category. We have highlighted the characteristic features of these universal modalities in the reflection. Consequental from the first

row of the network is the second row – general modalities of reflection, revealing its orienting-research ontology. The principle of triangulation of reflection's modalities allowed us to identify new modalities as a general plan: temporal, multidimensional, conscious, transcendental, transgredient, sufficient and their opposites.

3.1. The First Row of Modalities

The first row consists of ontic modalities of a real "to be", a possible "may be", a necessary "cannot fail"–a positive triangle of modalities. Not real "not to be", impossible "cannot be", and random "may not be"–a negative triangle of modalities. The paradox of reflection is that ontic modalities investigate objects that have these ontic modalities. Opposite modalities have a high connection strength between themselves. The average strength of the link indicates the self-sufficiency of the modalities in explaining the existing world.

3.2. The Second Row of Modalities

3.2.1. Results of Factor and Correlation Analyzes of the Second Row Modalities

Positive and negative modalities of the first row have six kinds of relationships with each other, derivatives of which are modalities of the second row. Triangulation is not just a combination of three elements. Each of the six modalities relationships is positive and negative. Each positive form corresponds to a specific modality of the second row: multidimensional, conscious, sufficient, temporal, transgredient, transcendental. Each negative form corresponds to the opposite modality: not multidimensional, unconscious, inadequate, not temporal, not transgredient, not transcendental. The negative form of relations in one pair of opposite modalities is a positive form in another pair of opposite modalities.

In modalities of the second row of the triangular network, three factors are singled out by factor analysis. The first forms modalities of sufficient and insufficient. The "Focus of Reflection" questionnaire does not diagnose transcendental and nontranscendental modalities. Using modal analysis,

we found that these modalities form one factor with modalities of sufficient and insufficient. The second and the third factors make up pair modalities that are interconnected by correlation links. Modalities of the temporal and the conscious, and their opposites have strong bonds between each other ($r = 0.60$ and $r = -0.60$, $p \leq 0.001$) and constitute the second factor. Modalities are multidimensional and transgredient, and their opposites have an average bond strength ($r = 0.39$ and $r = -0.39$, $p \leq 0.001$). The second row of modalities, related to general modalities, has weak links between the multidimensional and sufficient modalities, and their opposites ($r = 0.17$ and $r = -0.17$, $p \leq 0.001$).

3.2.2. Modal Analysis

1) The relation of real – possible – an accidental forms the modality of the sufficient. The negative form of the relationship between unreal – impossible – necessary forms the modality of insufficient.

2) The relation of unreal – impossible – necessary is formed by the modality of transcendent. The negative form of modalities: not unreal – not impossible – not necessary – is a form of real – possible – accidental and refers to a non-transcendental modality. Two types of relationships, the first and the second, in their negative form correspond to the positive form of another relationship: the first to the second and the second to the first. Thus, with the denial of a sufficient, the transcendent takes place, and with the denial of the transcendent, an acceptance of the sufficient takes place. Behind any denial is the acceptance of something else.

3) The relation of unreal – possible – accidental is the essence of the modality that is not transgredient. The negative form is the relation of the real – the impossible – the necessary, forms the modality of the transgredient.

4) Multidimensional modality forms the relation of the real – impossible – necessary. The negative form corresponds to the modality of non-multidimensional (unreal – possible – accidental). A case, when denying non-transgender, multidimensional

adoption takes place. A case, when denying the multidimensional, non-transgridient is accepted.

5) The relation of unreal – possible – necessary forms the modality of the conscious. The negative form corresponds to the modality of the unconscious (real – impossible – accidental). 6) The relation of real – impossible – accidental refers to the modality of non-temporal. The modality of temporal (unreal – possible – necessary) is formed by the negative form. In denial of the conscious, temporal is not accepted. When temporal is negated, the conscious is accepted. At the same time, temporal is associated with the conscious (r = 0.60, p ≤ 0.001) and has a feedback with the unconscious (r = –0.60, p ≤ 0.001). The modality of non-temporal has opposite connections (Table 3).

4. Discussion

The modality for interpreting and defining relationships is a multifaceted form. In our earlier work [], by establishing logical connections, we distinguished three groups of triangular relations between the second-row modalities: 1) if transgredient, then not transcendent; if transcendental, then not transgredient; 2) if multidimensional, then unconscious; if conscious, then not multidimensional; 3) if temporal, then sufficient; if not temporal, then insufficient. These relationships were not confirmed by the factor analysis, which we presented in this paper. More complex relationships between the second-line modalities were discovered.

Philosophy is used to have an experience of applying the principle of pair relations – the dual principle. M. Epstein, this principle has been applied to the relationship between ontic, epimistic and potency modalities. Four categories are associated in pairs – apossible with a random, an impossible with a necessary.

Oppositions considered by M. Epstein are found in triangular relations in combination with the real and unreal. Triangulation makes it possible to equally represent three ontic modalities, whereas the pair relation of modalities is built in relation to the third

modality, affecting the striving of being and non-being towards one another or from each other [8].

In M. Epstein's concept of epistemic modalities, the possible is an assumption (hypothesis), a random one is doubt (skepticism). The introduction of the third modality of the real know, gives support to a fact that can be as we know, obvious, and do not know, it must be investigated. In the first case, the relations of the three ontic modalities give rise to the modality of the sufficient, in the second case, the modality is not transcendental. The relations of the possible and the casual with the modality of the unreal are characterized by the absence of a support for the fact. Assumption and doubt without the fact give rise to modalities that are not trans-gradient and not multidimensional. The absence of a fact is replaced by an ideal object. On the one hand, doubts do not allow to set boundaries in the hypothesis, which requires reliance on the real, on the other hand, the lack of real leads to increased doubts in the assumption that it does not allow to see the reflective ideal object multidimensionally. This is due to the desire of doubt to resolve, which leads to a reduction, simplification, which apriori are not multidimensional and non-trans-gradient.

In an impossible and necessary, by the opinion of M. Epstein, epistimized analogues are incomprehensibility and confidence. Their paired relationships of real / unreal, the epistimistic analogue of which is to know / not to know, give rise to faith and wisdom []. In the triangular relationship, knowing / not knowing is involved in the relationship and the relationship of three modalities incomprehensibility – confidence – knowing how to epistymic analogs of ontic modalities, we denote confidence in the incomprehensibility of knowledge / ignorance – the modality of transgridient and multidimensional. On the one hand, it is impossible to know multidimensionality, on the other hand, confidence itself to put the boundary in the form of incomprehensibility, the inability to know is established in the reflection of the boundary that must be overcome. The relationship

of incomprehensibility – confidence – ignorance engenders modalities of transcendent and inadequate. In the reflection, the transcendent corresponds to imparting meaning and striving for the knowledge of truth. From one side, these relations of three modalities give a break from knowledge to ignorance, but confidence in it and that it is incomprehensible, that is, in general, transcendental, from the other side, this relationship without knowledge support and a fact carry a certain inadequacy for completeness of the reflection in relation to something and about something.

Modalities and their relationships imply a consistent interpretation. Our studies of the relationship between ontic modalities and their epistimistic analogues are based on the research of M. Epstein. Otic and epistemic types of modalities as species can be applied to understand the essence of reflection. Potential modalities, distinguished by M. Epstein on the basis of the potential analogue "can" ontic "to be," can become a support in the study of the reflection of its focus on the activity of the reflection mechanism – motive – will, penetrating the modality []. For our part, the application of epistimistic modalities for reflection on the basis of the triangular principle of the relationship between modalities can be considered a deepening of the existing knowledge about modalities in the field of general methodology and, corresponding to the reflection, like any other objects, such as thinking, including. The first row, consisting of relations between ontic modalities, belongs to the field of general methodology, the second row – to the general methodology and only the third row will relate to a private methodology, which reveals special, special, a characteristic only for reflection modalities. These private modalities, due to the objectivity of reflection – reflection in consciousness, thinking, activity, personality, will have in themselves a trace of modalities of the subject area of reflection. About this our subsequent research.

Compared to pairing, triangulation expands the range of separating types of modal relations. Rela-

tions such as the relation of possible and necessary, impossible and casual in their pairs with respect to reality were not considered by M. Epstein. The relation of possible – necessary – unreal gives rise to modalities of the temporal and the conscious, coordinated among themselves. The necessary and the possible strives for the real, the necessary limits the possible, but the unreal is included in the possible, and the necessary contradicts the unreal. In such a combination, there is a weak opposition of the necessary and unreal, as well as the coherence of the possible and unreal, the average power of the opposition of the necessary and possible. The emergence of the presence of such a relationship reflects what is carried out in the reflection: goals, time, proposed actions, thoughts, projects and other things. This corresponds to the category transtemporal. We, designating this as temporal, made time a priority. All of these are in reflection – events, impressions, interpretations, and more, consist in the present tense, in spite of the fact that this is the past or possible future, is consistent with certain goals and meanings. Objectives, events, interpretations and other things change, the alignment of times remains unchanged, so we have attributed this characteristic to modality as a priority for designating modality. Such coordination can be carried out only consciously. When something has already happened and a reflection is carried out on this fact, then an impossible acquires features not of the fact that this cannot happen at all, but an enumeration of what could be, but it was not. The casual tends to the real, thereby strengthening the real in this threefold relationship, but remains to some extent unconscious and violates temporality. The unconscious in reflection, singled out by A. V. Rossokhin [20] in understanding and analyzing an event, rushes out, due to the real. At the same time, it is impossible for comprehension and cognition in its entirety. In the analysis of an event, seemingly random events, thoughts, and more emerge from it in association. Consequently, the relationship of the impossible (the epistemic analogue

of which is unknown, unknowable, incomprehensible, inconceivable, unrepresentable, inadmissibility) is accidental (the epistemic analog of which is doubtful) and real (the epistemic analog of which is knowledge) expresses that it is impossible to admit exact or this knowledge, but it is impossible it is. This corresponds to the non-temporal and unconscious, as unconscious.

In psychology, a polymodal analysis of personality and motivation [5], a modal view of thinking [33], and perception modalities [1] are already known. Reflection is associated with all the listed phenomena. Perspective is the analysis of modal links between them to reach the ideas of unity, with which the modal representation is connected.

5. Conclusions

We examined the essence and integrity of reflection with the help of the category of modality and introduced the principle of triangulation into relations between modalities. In the triangular network of reflection, we distinguished universal, general, and specific modalities of reflection. In this article, we examined the universal and general modalities of reflection. Universal modalities: the real, the possible, the necessary, and their opposites, made up the first row in a triangular network. General modalities: multidimensional, conscious, sufficient, temporal, transgredient, transcendental, and their opposites, made up the second row of the triangular network. Modalities of the second row are derived from the first row of modalities. Each row in the factor dimension has a three-factor structure. The modal concept of reflection is being developed for the first time and has practical significance in areas of purposeful development of the reflection in the framework of education and practical activities. Also the development of new psychodiagnostic tools and reflection training tools; development of a linguistic map of reflection modality and ways of working with a text on recognition of reflection modality in it.

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"CURVE MIRROR" AND THE AUTHENTICITY OF REFLECTION: THE THIRD ROW OF A TRIANGULAR NETWORK OF MODALITIES

Abstract. In modern psychology of the post-non-classical period, integrity of objects and phenomena is investigated. Modal understanding of the world is holistic, not denying consistency and structure. In this article, we applied for a modal analysis and had built a triangular network of reflection modalities. We focused on the features of the third-row modalities. Results of correlation analysis do not contradict with logical conclusions about a relationship between the modalities of these series. Also, we defined groups, subgroups and types of modalities. The third row consists of three groups of modalities. The first group includes 72 modalities that are responsible for distortion of reflection, the second group includes 64 modalities that are responsible for accuracy of reflection, and the third group includes 24 modalities that define a relationship between two previous groups. The construction of a triangular network allowed us to identify and investigate qualitative characteristics of modalities from the first group, which were previously not in the field of vision of the psychology of reflection.

Keywords: reflection; modality; triangular network; integrity.

1. Introduction

Traditionally, reflection was assigned the role of the source of the truth of knowledge received by a person about his thinking, consciousness, activity, about another person, about his personality, etc., about how to relate to the inner and outer world of a person. Various types of distortions in knowledge, representation, and understanding related to the unconscious, the characteristics of perception or thinking. Psychology studied thinking, knowledge, personality, their features, but did not examine reflection from the view of truth and falsity in itself. We found that these distortions are not realized in thought itself, but in reflection, which creates an idea of thinking, not in knowledge itself, but in the reflection that generates this knowledge, not in the personality itself, but in reflection, that is how a person is aware of himself.

The psychology of reflection has quite a long history. Reflection is being investigated in personality [2; 13; 17; 34], activity and communication [1; 3, 6–7; 15; 21], cognition [2; 14, 19–20, 24, 30–31], in creative decision tasks [22] and false beliefs [5], and more. The non-classical paradigm outlines such aspects in reflection as mechanisms [1; 5; 22; 24; 29], metacognitive mechanism [9–10], kinds [1, 22],

determinants[1; 9; 22; 25], processes [1; 3; 30] and ways of development [1; 7]. Reflection is considered as a mechanism or a mental process. A great variety of researches about reflection shows us how diversified and multidimensional this phenomenon can be. All conceptions had been built on a basis of phenomenological, structural and functional, and structural and attributive approaches. Reflection became an object of epistemological approach. Results from different researches were generalized through the development of a "reflection meta model" [27]. We came to conclusion that our research should be oriented to different structural units in reflection. These structural units are reflection integrity manifestations in this or that way, they are not the reflection integrity as it is. We mean Reflection as the highest level of organic systems' mental development where new mental reality is reflected, researched, regulated, corrected, organized by mental resources, and this new mental reality is different from the real one but aim to it. This is our definition that we use for this article. Reflection penetrates into our thinking, consciousness, perception, feelings, personality, activity, communication, all that mental. Reflection is considered as a prism which is through the real world reflects in mental phenomena. Lev Vygotsky studied relations between thinking and reflection in ontogenesis. He had found that in early childhood our thinking development influence on development of reflection, but in adolescence he marked the opposite relation that the development of reflection influence on the development of logical thinking [33]. An analysis of mental integrity units appears in the cultural-historical approach developed by L. S. Vygotsky. Thus, the unity of affect and intelligence is expressed in a unit of integrity called experience. The methodology of L. S. Vygotsky allows us to go by identifying units of integrity. We believe that one of the types of integrity units is modality. Looking from the integrity point of view, we think reflection may be known through modalities and through modalities distinguishing. Modal approach for reflection was undertaken in re-

searches of V. K. Vasilyev [32] и L. M. Naydyonova [18]. Each author understands modality differently thereafter emphasizes different kinds of reflection's modalities. We are making our new contribution to the development of the theory of modal psychology of reflection. By the concept of modality, we mean the separation of ontological essence of psychological phenomena [4; 16]. This is different from the formulation of linguistic and logical meanings.

To solve the task, stated in the topic of this article, it is not enough for us to single out the modalities of reflection. We need to rely on a universal ontology that reveals the non-identity of reflection to the real world [11; 23]. This will allow us to build a hypothesis about the existence in reflection of modalities striving for a true reflection of reality and the modalities due to which distortion is realized in the reflection of reality

We consider N. Hartman critical ontology [8] as a basis for reflection intrinsic features research and studying it in non-subject spheres like mentality, personality, activity, communication, cognition, etc. but internally, as it is. Hartman ontology does not identify mentality with existence. In N. Hartman ontology all ontic (or ontological) modalities are characteristics to each strata and each strata's stage. We consider reflection as the highest stage of the psychological (spiritual) strata. Thus we understand and analyze reflection through the modalities of necessary, possible, real and their oppositions as well as through their relation that is the basis for other reflection modalities manifestation. Reflection is a polymodal object. Ontologically we consider modality analysis as an object analysis (including reflection analysis) from the point of view of modal dominants of possible, real, necessary and their oppositions, that allows us to build connections between them.

To distinguish connections between modalities we have applied our new principle of triangularity, which performs well for the triple logics. The principle application to the modalities enabled us to build the reflection modalities network and to distinguish

three rows in the network. Every following modalities row is derived from the previous one. The first raw consists with fundament modalities: necessary – accidental, possible – impossible, real – unreal. Giving notion to the second and third modality rows in the polymodal reflection network became possible through L. S. Vygotsky psychology cultural and historical foundations[33]. The cultural and historical concept frame enables us to find modalities in reflection which characterize reflection from cultural and historic positions, cultural and historic situation countermotion and an individual development ontogenesis situation. Thus, talking about modal essence of reflection we can distinguish notions, meanings, ideas, feelings, illusions, rationality, meaningless, values, experience, knowledge, etc. – everything that concerns understanding (understanding can exist without reflection but not contrary) and subject relation (collective subject) to the product and to the process of one's mentality, cognition, activity and personal development in the cultural and historic situation. Speculating upon the assumption we distinguish the second row-modalities that derive from triangular relations between ontic modalities making the first row. The second-row modalities are: temporal, multidimensional, transcendent, transgredient, cognitive, sufficient and their opposites. The second row of modalities is referred to the general reflection cultural and historical ontology. The first-row and the second-row modalities do not reveal possibilities of our reality perception distortion in the reflection. Stating the third row of the reflection modalities we have found out a clear division into modalities, responsible for the distortion as well as the modalities, regulating realities between the truth and the distortion. The third-row modalities correspond to the particular that is orientated and investigative reflection ontology and are derived from relations between the second-row modalities. We are describing the way of the third-row modalities distinguishing and indication of modalities responsible for the reflection truth and distortion.

2. Materials and Methods

The study was carried out in accordance with the Code of Ethics of the World Medical Association (Helsinki Declaration). We applied testing with a "Focus of Reflection" survey[26]. The survey comprises 124 questions, united into 16 dichotomous scales (if a respondent has or does not have the measured quality), making pairs of opposite modalities (negative results on one scale are counted as positive ones on the other scale) and 13 orientation scales (intentionality) of reflection. There is an ordinal scale in this survey. According to theoretical and empirical data that we have gotten from reflexive texts analysis, we formed scales with questions which is aimed to enquire signs of orientation and modalities of reflection. By the reflexive texts we mean self-analysis and analysis of other person in a situation of communication and intellectually-practical co-activity. For example, the scale of modality "multidimensional" which is including 13 direct questions and 7 reverse ones has significant signs as: a) fact review from different points of view b) searching for a few decisions in a problem situation, not only the one c) from all decision possibilities make a choice for the best one reliable with most amount of criteria d) finding a large number of causal relationships, generated by the time continuum- past, present, future e) probabilistic forecasting. Each question corresponds to a modality or an orientation. E.g. a statement – question like "In most of the cases You analyze a situation from different points of view" is related to the reality modality and systematization orientation. A "Mostly You need to get the point of an event" statement – question is related to the conscious modality and the integrity orientation. We do not take intentionality into account in this article. The social desirability scale consists of three questions, e.g.: "As a child you could point out the didactic sense in a fairy-tale to apply in your life" and three corresponding answers on two questions. With the help of the respondent's reflection (when a person answers the questions), we examine his reflection (questions from the questionnaire about his reflection). Respondents' answers,

positive "yes" and negative "no," are assigned a corresponding score of 1 and 0. Psychometric parameters of the questionnaire: "difficulty index" of tasks ranging from 0.3 to 0.7, Cronbach alpha 0.824, Ferguson coefficient 0.870, the presence of significant correlations with recognized and successfully applied methods for the diagnosis of reflection ("Method for determining an individual measure of reflexivity" by A. V. Karpova and V. V. Ponomareva (2000), "Method for the study of self-relationship" S. R. Panteleeva (1993), Differential reflexivity test and "DA Leontiev and EN Aspen (2014)). A detailed description of the development stages of the questionnaire and the results obtained is presented in the work of T. E. Sizikova [29].

The "Focus of Reflection" questioner is targeted to test the first two reflection modality rows in the triangular network. The third modality row is constructed on the basis of the total score of all three modalities together. The relation with integrity can be of two kinds: the integral is bigger than the total score of its parts (it defines the second modalities row) and the integral is equal to the total score of its parts (this is the basis for the third modalities row). Quantity characteristics of the third-row modalities were taken from the total score of three modalities, related to each other. For triple relations where 12 second-row modalities were taken, we distinguished 220 possible variants of triple relations using a combination formula (combinatorics) $C_n^k = \dfrac{n!}{k!(n-k)}$, where from $n = 12$ elements of the group by $k = 3$ elements differing in at least one element, 220 combinations are formed. We take into consideration 160 of them. These are modalities with no oppositions in the same kind of relation: E.g. the relation "temporal – multidimensional – non-temporal" includes two opposing modalities so we do not take it into consideration for it, as we presume, related to psychiatric deviations that is not the subject of our research. The 160 kinds of triple relations between modalities are formed into groups, then into subgroups and into kinds in the subgroups, based on

general characteristics. These groups' definition, description and verification are related to modal analysis and statistical analyzes (correlation and factorial).

The modal analysis presumed distinguishing modalities basing on the triangularity principle (building triple relations among modalities). Ontic modalities of the necessary, the possible, the real and their opposites formed a baseline for building the modalities network. All the modalities distinguished and united into groups and subgroups inside the groups we called on the basis of cultural and historical concern and orientational and research essence of the reflection. We have distinguished such a meaning for the modality that would correspond to the triangularity results in relations of the first-row and the second-row modalities. In the formulas of the third-row modalities, acquired through triangularity method (the relation of three modalities) of the first and the second rows, we have distinguished the second and the first row modalities dynamic equilibrium deviation. The deviation is a basic characteristic to denote (name) and give notion to the third-row modalities.

The sample included 807 people (261 men, 546 women), aged 17 to 81 years (the approval code iso 3534–2:2019, 1.3.6). Respondents had a different level of education and place of residence in Russia.

We have applied the factor analysis to verify the three groups of the third row modalities. While standardizing the acquired data, the total contingency volume was 668 people (452 women., 216 men.; general age – 26 years; standard deviation – 11.501; dispersion – 132.290). The analysis of normal value distribution, its deviation to groups, divided on the basis of social desirability scale scores, reveals us on what types of modality tested are inclined to exaggerate or to diminish while reflexing. Correlation analysis reveals connections between the modalities in the third-row modalities groups. The correlations given there correspond to the confidence level p ≤ 0.001. For statistical analysis of the test results, we used STATISTICA version 10 program.

3. Results

3.1 Analysis of normal distribution of the sample of respondents. Deviations in the modalities of reflection

For oblique modalities definition where reality distortions may occur (a person distorts reality about oneself and about his/her reflection) we have studied all the first and the second-row modalities and distinguished deviations in the normal sample distribution on these modalities. To the first-row modalities we refer possible, necessary and real and their opposites. To the second-row modalities we refer the following modalities: 1) Temporal / non-temporal modalities mean consonance and dissonance of any temporal types in the reflection; 2) Multidimensional /non-multidimensional modalities mean psychological dimensions where understanding and realizing take place (multidimensional "I" – concept, etc.); 3) Transgredient /non-transgredient modalities mean overcoming frames in any objectless under the reflection; 4) Transcendent / non-transcendent modalities mean notional spiritual side of the reflection; 5) Conscious / unconscious modalities mean operating with notions, meanings as well as causality and logic of the implicit and explicit text of a person; 6) Sufficiency / non-sufficiency modalities mean completion or non-completion of the reflective contents building processes and living it through. Analysis of deviations in normal distribution of the sample of respondents (807 people) according to results of the Focus of Reflection questionnaire indirectly proves the presence of such modalities in the triangular network that distort and truly reflect reality. We identified deviations from normal distribution on scales: necessary, random, possible, impossible, real, unreal, conscious, unconscious, transgender, non-transgredient. All the first-row modalities and two pairs of six from the second-row modalities may enable the distortion. The tendency to distortions prevails under the tendency to the truth in reflection. When a subject exaggerates or diminishes something while reflecting this is one's reflection with the tendency to the distortion. Normal distribution of the sample of respondents is maintained at 0–1 point on the social desirability scale of the Focus of Reflection questionnaire. Respondents tend to veracity in realizing the reality of other people and their own reality This is only one sixth of the total sample of respondents.

3.2 Modal analysis. Construction of the third row of modalities in a polymodal triangular reflection network. Characteristics of the third row of modalities

We have grouped the third row of modalities according to the one criteria: a degree of amplification of identical the first-row modalities and diametrically opposed deviations of dynamic equilibrium in the first-row modalities. Three groups combined into 160 the third-row modalities. In each group, subgroups and types of modalities were identified. E.g. the first group encompassing six modality subgroups was called "distorting modalities". The first kind we have called "focus on a random factor" consists of two relations of the second-row modalities: transcendental – non transgredient – not multidimensional; non transgredient – insufficient – not multidimensional. The general formula that unites these relations can be expressed by the following relations: transcendental – non transgredient – insufficient – not multidimensional. We unite them so that not to lose all the characteristics of this kind of the third-row modalities. Every one of these modalities consists of the first-row modalities relations. We have united these relations and got the following formula: dual amplification (that is repeated twice) of the modality "possible" – dual amplification of the modality "accidental" – triple amplification of the modality "unreal" – the modality "impossible" – the modality "necessary". Deviation of dynamic equilibrium in the direction of relationship: "possible" – "accidental" – triple amplification of "unreal". The dynamic equilibrium and its deviation is the main characteristic defining essence of this kind of modalities. It identifies what we have called the "focus on a random factor" while studying an object and its

connections or an event and its connections. Thus we have distinguished every kind of the third-row modalities. Kinds of modalities unification into subgroups was fulfilled through the dynamic equilibrium identification that is the result of all the modalities relations formula characteristic to all the kinds and equal to all the kinds of the second-row modalities relations. General relation of the second-row modalities is characteristic to this group: temporal – conscious and dynamical equilibrium deviation to the relation: possible – accidental – triple amplified unreal. Taking these characteristics into account we have identified this subgroup as " rational distortion". Modalities of the first group create distortions in the reflection. Modalities of the second group allow you to get true knowledge. The third group of modalities regulates relations between two groups; the result is genuine or not genuine reflexive knowledge. There is a very weak, significant positive correlation between groups ($r = 0.178$), but there are strong and medium links between subgroups. For a visual representation of the triangular network of reflection modalities, we present a fragment of it (Fig. 1). Triangulation is a search for a third point using the other two, thereby forming a triangle. The vertices of the triangle are indicated by the legend of the names of the modalities.
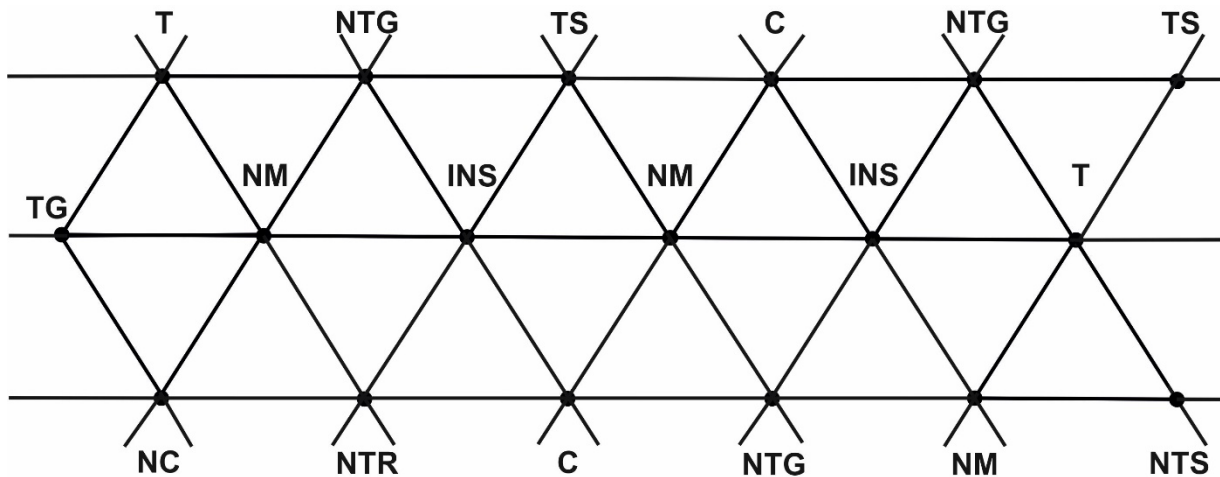
Figure 1. Fragment of the triangular network of the third-line reflection modalities

TS – transcendental, **NTS** – not transcendental, **TG** – transgredient, **NTG** – not transgredient, **T** – temporal, **NT** – not temporal, **S** – sufficient, **INS** – insufficient, **C** – conscious, **NC** – not conscious, **M** – multidimensional, **NM** – not multidimensional

1. The first group consists of 72 third-row modalities. The first subgroup combines modalities of rational distortion of the real: focusing on a random factor, grouping by a secondary argument, a fictional one (dynamic equilibrium has deviations in the direction of conscious and temporal and in the direction of possible – necessary – triply enhanced unreal). The second subgroup – an irrational distortion: substitution, transference, exclusion (dynamic equilibrium has deviations in the direction of the not temporal – the unconscious and in the direction of accidental – impossible – triply enhanced real).

The third subgroup combines modalities associated with rational types of assumptions: projective, instrumental, existential (dynamic equilibrium has deviations in the direction of insufficient – transcendent and in the direction of impossible – unreal and triply enhanced necessary). The fourth subgroup combines modalities associated with irrational assumption: erroneous, illusory, and questionable (dynamic equilibrium has deviations in the direction of non-transcendental – sufficient and in the direction of real – possible – triply enhanced accidental). The fifth subgroup consists of modalities of rational

idealization: idealized idea, projective idea and fantastic idea (dynamic equilibrium has deviations in the direction of not multidimensional – non transgredient and in the direction of unreal – accidental – triply enhanced possible). The opposite sixth subgroup – irrational idealization combines modalities: confirmation of faith – a miracle; charm by faith; strengthening of faith – the argument (dynamic equilibrium has deviations in the direction of multidimensional – transgredient and in the direction of real – necessary – triply enhanced impossible). All the types in every six subgroups of modalities have significant strong direct correlative connections with each other. The minimal correlation ratio is (r =0.67) and the maximum correlation ratio is (r =0.86).

2. The second group of modalities is opposite to the first group of modalities and is associated with the reliability of reflection. It includes 64 modalities from the third row. Each type includes 8 third-row's modalities. The subgroups are not opposite to each other. The first subgroup "goal-setting" consists of two types of modalities (r = –0.996): the first type characterizes by irrelevance of reflection (dynamic equilibrium has deviations in the direction of unconscious – non-temporal and into the direction of accidental), and the second type – expedient in the reflection (dynamic equilibrium has deviations in the direction of conscious – temporary and into the direction of necessary), The second subgroup "understanding" consists of modalities of the first type – by understanding (dynamic equilibrium has deviations in the direction of multidimensional – transgredient and into the direction of necessary) and the second type – incomprehensible (dynamic equilibrium has deviations in the direction of not transgredient and not multidimensional and into the direction of accidental). The correlation ratio establishes a meaningful strong feedback between those types (r = – 0.996). The third subgroup "argumentation" consists of two types of modalities (r = –0.996): the first type – hypothetic or not argued (deviation of dynamic equilibrium in the direction of

transcendent and insufficient and into the direction of necessary) and the second type modalities which responsible for reliable argumentation (dynamic equilibrium has deviations in the direction of sufficient – non transcendental). The fourth subgroup "systematizing" combines of two types of modalities (r = –0.998): modalities are not systematized (dynamic equilibrium has deviations in the direction of not transgredient – unconscious – insufficient – transcendent – not temporary – not multidimensional and into the direction of accidental) and systematization (dynamic equilibrium has deviations in the direction of non-transcendental – conscious – sufficient – multidimensional – temporal – transcendental and into the direction of necessary).

3. The third group consists of 24 modalities of the third row, that are divided into six subgroups, each containing two types of modalities and each consisting of two third row modalities. They have a difficult task: resolving contradictions between the first and the second group. Modalities of the two subgroup types do not have a rigid contrast, they possess the same dynamic equilibrium deviation of the first-row and the second-row modalities. The opposite is specific to the modalities subgroups, i.e. dynamic equilibrium deviation of the first-row and the second-row modalities to the opposite sides in subgroups pairs. Modalities of the first subgroup "notional" are responsible for the meaning formation: emotional and sensual and intuitive (dynamic equilibrium has deviations in the direction of transgredient – transcendental – insufficient – multidimensional and into the direction of triply enhanced impossible). The second subgroup of modalities "defined" is connected to the modalities of notional definition and cultural definition (dynamic equilibrium has deviations in the direction of sufficient – non transgredient – non-transcendental – non-multidimensional and into the direction of triply enhanced accidental and triply enhanced possible). The third subgroup "stereotypical" consisted of types of modalities: modalities that form conviction and modalities that form evaluation (dynamic equilibrium

has deviations in the direction of conscious – transcendental – insufficient – temporal and into the direction of triply enhanced necessary and triply enhanced unreal).The fourth subgroup "problematical" includes types of modalities: modalities associated with various kinds of automatisms in thinking, speech, and consciousness; modalities associated with problematic, questions, and with discovery of discontinuities in logical connections (dynamic equilibrium has deviations in the direction of sufficient – non-transcendental – unconscious – not temporal and into the direction of triply enhanced accidental and triply enhanced real). The fifth subgroup of modalities "experienced" is associated with giving importance to one or another in reflection: modalities that responsible for determining significance; modalities that responsible for identifying non-significant (dynamic equilibrium has deviations in the direction of transgredient – multidimensional – unconscious – not temporal and into the direction of triply enhanced real and triply enhanced impossible). The sixth subgroup of modalities "axiological" is responsible for experience in reflection: modality characterizes selection of patterns; modality is the selection of situation (dynamic equilibrium has deviations in the direction of conscious – non-transgredient – non-multidimensional – temporal and into the direction of triply enhanced possible and triply enhanced unreal).

These correlative connections confirm logical and notional connection between the types of the modalities. Total opposition between the first and the second modalities subgroups, the third and the forth modalities groups and the fifth and the sixth modalities groups is characteristic to the connections. There are also some connections between non-opposite types of modalities. It enhances our understanding of the relation between distortion and tend to the truth is regulated in the reflection process.

3.3 Factor analysis of the types of modalities of the third row of the triangular network of reflection

The factor analysis in every three groups confirms relations between opposite subgroups and modalities types. In the first group of the third-row modalities we distinguish three factors combining opposite subgroups. The first factor encompasses the third and the fourth modalities subgroups (rational and irrational supposition) with total dispersion of 6.686 and fraction of 0.371. The second factor encompasses modalities of rational and irrational distortion (total dispersion: 5.803, fraction: 0.322). The third factor encompasses modalities of the fifth and the sixth subgroups, i.e. rational and irrational idealization (total dispersion: 0.506, fraction: 0.305). The factors correspond completely thus it confirms the way we distinguish the modalities subgroups and types through the modal analysis.

In the second group of the third-row modalities responsible for real images and knowledge in reflection we distinguish three factors. The first factor combines the opposites of the two modalities groups: understandable ($p = 0.984$), not understandable ($p = -0.984$), systematized ($p = -0.709$), not systematized ($p = 0.707$). These connections reveal deep aspects of reflection: understandable is connected to not systematized and it may remain in this way while systematized may be not understandable, for understanding is grasping the essence instead of cause-effect relations analysis or systematization. Such modalities as reasonable ($p = -0.988$) and non-reasonable ($p = 0.988$) make the second factor and reveal independence of the subgroup. The third factor encompasses such modalities as efficient (goal efficient) ($p = 0.985$) and non-efficient ($p = -0.984$). These factors confirm the existence of the modalities subgroups and types we have distinguished in this group through the modal analysis.

In the third group of modalities we distinguish two factors. The first one combines modalities of notional marking ($p = 0.818$), pejorative ($p = 0.976$) and ensured (0.937). To put it briefly, these are: "notion", "value" and "belief". Their opposites are: cultural markings and problematical, that are represented in the following modalities: cultural marking ($p = -0.817$), actual setting of problem-

atic ($p = -0.938$) and fixated setting of problematic ($p= -0.976$). The modalities connection mutually specifies the following: problematic is opposite to stereotyping while cultural marking that is broad on its nature is opposite to notional marking that is narrow on its nature. The second factor revealed the following connection: intuitive notional ($p = 0.784$), meaningful significant ($p = 0.841$) and meaningless axiological (0.978) are opposed by the modalities of experienced characteristic ($p = -0.978$), experienced situational ($p = -0.840$) and notional emotional and sensual ($p = -0.783$). The notion (intuitive) and significance in the reflection are opposed by experience and emotional and sensual notion-making.

The factors combine all the modalities types of the opposite subgroups, such as: experienced and significant; stereotypical and problematical; notional and signified, that confirms the modal analysis results.

4. Discussion

The modal reflection approach is a new direction in the reflection psychology research. There are only two works that distinguish reflection modalities. V. K. Vasilyev [32] reduces an idea of modality to a type of the reflection and identifies four types of reflection: intellectual, personal, praxeological and reflective in a form of dialogue. As means of the reflection modalities identification he applied calculation cases these types were mentioned in 120 scientific works on the reflection. L. M. Naydyonova [18] defined the following four reflection modalities: knowledge, experience, relations, feelings. She did not mention any means of their identification. Our new approach reflected contents of the above mentioned modalities, distinguished by V. K. Vasilyev and L. M. Naydyonova. We have explained our modalities distinguishing method, i.e. building the triangular network of modalities, whose elementary units are triple relations between ontic modalities. The relations between modalities are basic characteristics of the modalities derived from them. They give them cultural meaning on the basis of which the modality name, used in modal analysis and modal

category is identified. We come to notion of modality in the reflection through philosophical knowledge about modality and transform it into psychological knowledge.

To verify the reflection modalities, distinguished with help of the modal analysis of the reflection triangular network of the third row modalities, we have applied quantitative analysis method (correlation and factor methods) to the results of "Focus of Reflection" questioner (Sizikova, 2018), that helps to diagnose reflection directions and modalities of the first two rows from the triangular modalities network. We constructed the third row of modalities. Symmetrical correlations confirm opposition inside the modalities' pairs. Weak correlations between modalities' pairs confirm that modality is the unit of integrity, which is not dependent or tight related with other integrities. The integrity by itself is an independent unit. Relations between singular units are mostly the result of reconstruction as a way for deeply understanding of the polymodal essence of the reflection. We had checked that amount and a meaning of correlations increased in the third row of the triangular network of reflection, that means that deeply fractural differentiation connects modalities between each other stronger and this fact makes enable grouping them. The reduction procedure taking place in this case is justified so that to confirm the veracity of the constructed network. The correlation and factor analysis confirmed the modal analysis logical conclusions, thus verifying the triangular network of the reflection's third-row modalities. The third row of modalities comprises modalities, responsible for the truth in the reflection process and modalities, responsible for the distortion, i.e. "distorting mirror". The relations between the truth and the distortion are regulated by the modalities, responsible for bringing things, acquired through the reflection to the notion, significance, axiology, gaining experience, distinguishing the problematic and studying the stereotypical. Having acquired the necessary confirmation through the way psychology had being using for the century (testing, correlation and factor analysis), we can go on

developing our ideas. Future development of qualitative diagnostics method is considered to be prospective. The triangular network of reflection modalities could be applied for any text, which might be considered as a reflexive, and being analyzed through modal analysis. This method applies to speech utterances from autobiographical texts and reflexive psychological and philosophical texts of famous philosophers, psychologists and methodologists that confirm our full imagination of the reflection as the aspect possessing modalities, saturated with intention and developing inverse relations. Based on this method we can signify a place for reflection in false memories, in mind control, in forming of the inner paradigm, in taking place with conflict situation and psychological problem solving etc. Modal understanding of reflection reveals to us new possibilities for studying the reflection in ontogenesis from a very young age, studying the reflection of unconscious and studying the way to learn how to apply the reflection. Deeper studying of the distinguished triangular network three groups of the third row modalities enables us to develop new development methods of the second-row and the third-row modalities, responsible for reflective analysis, reflective understanding, reflective knowledge and experience to the true, the valid, close to real, both in human and in surrounding world and ones' relations.

5. Conclusions

We have posed a new and important question for psychology – the question of justification the distortion, evoked by reality of the reflection. We found an answer in the kernel of the reflection itself. It was the modal analysis of the modalities of the third row identification that helped us to reveal the distorting role of reflection and its possibility to find the truth. For the first time for the psychology of reflection, a thorough analysis of possible distortions in reflection has been developed, as well as its ability to obtain true, reliable knowledge, representation, understanding, etc. The answer to the question why in reflection there can be a true and false representation, understanding, and even perception, was not found when studying the structure, means and mechanisms of reflection. Only construction on the basis of the principle of triangulation of modalities (categories) of reflection allowed us to single out such modalities that are responsible for distortions – unconscious, irrational, dreaming, reliance on indirect arguments, substitutions, etc. Previously, these categories were not associated in psychology with reflection. We have identified three groups of reflection modalities in the third row of the triangular network of reflection modalities. Correlative connections, that were distinguished, show that there are logically non-contradictive ties between modalities inside the groups. Groups connections are of dialectical character: two opposite modalities groups are connected through the third one. The biggest modality group (the first group) unites modalities responsible for rational and irrational reality distortions in the reflection. The data acquired are useful in psychological consultation, learning, conflict management and personality development when it comes to purposive reflection development that tends to find the truth.

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iSSUES OF IMPROVING METHODS FOR DETERMINING INDICATORS IN BENCH TESTS OF TRAKTORS

Abstract. The article discusses the tasks of testing tractors on stead equipment to determine their power and fuel and economic indicators. The shortcomings of the available equipment are identified during the test. The role and importance of testing on modern bench test equipment is described. The advantages of new advanced technologies during testing, the use of modern stands and equipment for testing tractor engines are revealed. An analysis of the tests carried out on existing stands and equipment is done, the tasks are set for the use of modern measuring systems that allow to qualitatively increase the level of testing.

Keywords: indicators, bench tests, modern equipment, test centers, information-measuring systems, engine tests.

Introduction. Creation of new and modernization of produced agricultural machines ends with their testing. Tests are the most important source of almost all reliable information about the properties, quality and

behavior of wheeled and tracked tractors and other equipment. Based on the test results, the technical and economic indicators of their functioning in various conditions are evaluated. On their basis, an information base is being formed for improving the design, manufacturing technology, operation, planning for the supply of spare parts and maintenance of agricultural machines. The main objective of the system of machine testing centers is to assist in the implementation of the state scientific and technical policy in the agricultural sector, to increase the efficiency of agricultural production through the introduction of advanced technologies and modern means of production.

Main part

Machine-testing centers ensure the economic independence of the republic from participants in the agricultural machinery and technology market.

To achieve these goals, testing centers should be provided not only with professional and competent personnel, but also use the most modern information-measuring systems and technologies in their arsenal.

Not all research centers of the near and far abroad countries of the former Soviet Union possess all the necessary equipment to carry out various types of tests of wheeled, tracked vehicles, tractors and vehicles, and most of the existing test benches are morally and physically outdated.

The most common and demanded in test centers and laboratories of educational institutions was a standard bench equipment designed to determine the characteristics of tractor engines.

The Center for Testing Agricultural Machinery and Technology (CITT) also has bench equipment for testing tractor engines. This stand allows brake testing of tractors manufactured in the Republic and imported from abroad. Although this equipment is quite outdated, it still functions properly, but has a number of drawbacks. A study of the operation of the equipment showed that basically the disadvantages of the stand are the complexity of the tests, in obtaining data, processing the information received.

The experiments showed that when testing on existing bench equipment, it is mainly necessary to obtain data in manual mode, since each indicator needs to be taken separately, which causes inconvenience and is reflected in the delayed experiments in time. For the entire cycle of experiments requires several specialists. The obtained data require analysis, processing and calculation of determined indicators. On average, obtaining indicators after conducting experiments on this bench equipment can take from two to four business days.

Figure 1. Electro-brake stand GPF-5–17N with weighing device "Rapido" in working condition when testing the tractor engine

Figure 1 shows one of the moments during the tests, a general view of the GPF-5–17N electrobrake test bench with the Rapido weighing device (weighing head) for testing tractor engines through the PTO shaft.

Below are the power and fuel and economic indicators obtained during testing of one of the tractors (table1), obtained during experiments on bench equipment GPF-5–17N with a weighing device "Rapido" [1].

Table 1. – Tractor test results via PTO on bench equipment

PTO power. kW	Speed. min⁻¹		Fuel consumption. kg /h	Specific fuel consumption. g/kW h
	engine crankshaft	PTO shank		
Maximum power on PTO				
77.04	1729	843.9	22.64	293.88
Change in PTO load at rated engine speed				
65.07	2201	1074	25.00	384.20
62.90	2199	1073	24.49	389.33
Change in PTO shaft rotational speed at full load				
62.22	2196	1072	23.89	384.01
61.31	2186	1066.9	24.27	395.86
61.83	2193	1071	23.89	386.42
61.83	2193	1071	23.84	385.57
65.51	2182	1064.7	24.43	372.99
70.60	2050	1000.7	25.35	359.09
70.60	2050	1000.7	25.00	354.10
71.47	1935	944.6	24.38	341.13
72.59	1896	925.18	23.63	325.58
75.66	1803	879.86	23.13	305.66
77.04	1729	843.9	22.64	293.88
75.92	1574	768.35	21.34	281.14
74.26	1468	716.55	20.49	275.97
71.62	1350	658.99	19.60	273.69
70.88	1327	647.5	19.12	269.68

During the tests, the following atmospheric conditions were noted:
  – ambient temperature, 29.4 °C;
  – atmospheric pressure, 97.2 kPa;
  – relative humidity of air, 36%;
Maximum coolant temperature, 80 °C.
Engine oil temperature, 80 °C.

Table 2 shows the tractor performance after bench tests reduced to standard atmospheric conditions.

According to the results of brake tests at the tractor stand, the power on the PTO shaft at the rated engine speed was 64.17 kW (87.27 hp), instead of 83.85 kW (111.8 hp) according to the factory data. The specific fuel consumption at this power was 380.46 g / (kW·h), instead of not more than 239 g / (kW·h) according to the manufacturer.

The maximum power on the PTO was 81.5 kW (110.85 hp) with a crankshaft speed of 1729 min⁻¹, i.e. It is located in the operating area of the high pressure fuel pump corrector, and not at the nominal frequency (2200 min⁻¹) of the crankshaft. The rated engine operating power (2200 min⁻¹) was

74.62 kW (101.5 h p) and 17.5% less than in the factory (90.45 kW (123.0 hp)). The specific fuel consumption at engine operating power at a nominal crankshaft speed was 327.2g / kW/h. The correct torque factor was 20%, instead of 30%, according to the plant.

Table 2. – Power and fuel-economic indicators of the tested tractor, reduced to standard atmospheric conditions

The name of indicators	The value of indicators	
	according to the factory	according to tests
1	2	3
1. Performance indicators of the tractor on the PTO:		
–maximum power on the PTO shaft at a regulated rotational speed $(2200\,\text{min}^{-1})$ of the engine crankshaft, kW (hp)	83.85(111.85)	64.17(87.27)
–specific fuel consumption at a nominal speed of $2200\,\text{min}^{-1}$, g/(kW h)	239	380.46
Maximum power on PTO, kW	–	81.5(110.85)
Engine speed at maximum PTO power, min^{-1}	–	1729
2. Engine Performance:		
–engine power in the configuration and under the conditions of the corresponding operational power at a regulated speed, Kw (hp)	90.45(123.0)	74.62(101.5)
–engine speed at operating power, min^{-1}	2200	2200
–specific fuel consumption g/kW·h	–	327.2
–corrective factor of safety factor,%	30	20

All the above data, as noted, require calculations, are rather laborious and take away additional time from specialists.

Currently, the Center for Testing of Agricultural Machinery and Technologies is developing design for the modernization of electro-brake bench equipment based on the automation of the technological process of testing equipment with the determination of their power and fuel-economic indicators based on digital measurement technologies and computer processing of information.

The development consists in the creation and inclusion in the composition of the bench equipment: – measuring part, built on measuring units; – information – computing part, consisting of a computer and a display. The measuring part consists of: measuring instruments, measuring electronic units, measuring channels, measuring modules, microprocessors, microcontrollers, an interface and a set of various kinds of primary transducers.

The project provides for the development of high-tech bench equipment for environmental, functional and power tests for all types of tractors and vehicles.

The use of modernized bench equipment will allow to receive and reproduce the following using software:

– continuous (dynamic) and discrete (static) power measurement;

– load simulation at a constant speed, constant speed and traction;

– graphic and digital display of power losses in the transmission, power and engine torque;

– display of speed, speed and oil temperature during the power test, recalculation of engine power in accordance with DIN70020, EWG 80/1269, ISO 1585, JIS D1001, SAE J 1349.

Characteristic for recent years, the use of modern information technologies [2] in the testing system of agricultural machinery [2] is explained by the inten-

sive development of computer equipment and other tools and their introduction into test benches and equipment to obtain information about the parameters of various objects and the characteristics of the processes.

In modern sectors of the automotive industry, mechanical engineering and in particular tractor manufacturing, there is very fierce competition in the field of quality, efficiency and economy of the produced vehicle models. For best results, a large number of tests at various levels are required. The results of these tests largely depend on the type and capabilities of the test equipment.

Modern testing equipment is able to reproduce any environmental factors and workloads acting on the studied object. At the same time, experimental costs can be up to 30% of the total cost of developing a tractor or machine, which is caused by the cost of creating a prototype, the acquisition and operation of expensive equipment.

An example of modern testing equipment is the DLG mobile testing laboratory (Germany) [3] shown in (Figure 2).

Figure 2. Test complex for checking power, brake performance and skidding of German tractors DLG Test Center

Each research center seeks to have its own unique testing equipment and highly qualified specialists who are able to manage this equipment. Tests of tractors, agricultural machines, designs of their units are carried out strictly in accordance with the standards of the research center.

Conclusions:

– Updating and modernizing existing test benches, through the development, application and implementation of a high-tech control system using modern control and measuring equipment, instruments and software, will increase the significance of the results of the test system as a whole, and will be-come useful in the information plan in solving design and research problems when design and creation of new equipment;

– The conversion of stands and devices to the level of modern testing equipment, which allows to test the performance and functionality, check the estimated resources, as well as implement a wide range of studies and tests of the dynamics, environmental friendliness and efficiency of engines, transmissions, tractors, agricultural machines and vehicles, will help to accelerate and solve development problems, identify promising areas for the revival of the industry in the Republic and updating the research base of testing centers.

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THE UNIVERSAL LAW OF EVOLUTION OF MATTER AND CONSCIOUSNESS

Abstract. Based on deductive logic, analysis of mathematical expressions and the most important concepts that define various physical parameters and fundamental properties of existing physical and humanitarian things in Nature, conclusions are obtained, logical and functional generalization of which corresponds to the status of the universal Law of Evolution of Matter and Consciousness, which includes the General Darwin's law of evolution as a special case. Numerous spheres that make up a wide variety of phenomena that determine the existence of Nature have been studied for compliance with the Law.

Keywords: elementary particles, universe, physical and humanitarian parameters, evolution.

The vector that defines the direction of exploration and development of ideas related to the solution of unusual and complex issues is set by the outstanding physicist and philosopher **Niels Bohr**, who has repeatedly stressed the importance of creating as crazy theories as possible…, [1].

The question has long been asked: Is there any functional pattern according to which there is an evolution and corresponding destruction of symmetries determining the world of fundamental properties of elementary particles, matter and consciousness in general?

Logic and analysis suggest that the creation of objects of increasing complexity occurs at discrete points of the evolutionary (DPE) process (Figure 1, stars). The relationship between the DPEs is determined by the mean geometric ratio (MGR). The value of time interval between the DPE is determined by the exhaustion of the existing systems complexity resource.

The theory of origin of biological species, which was published by **Charles Robert Darwin** in 1859, suggests that the process of creating more and more complex biological species also corresponds to the evolutionary process shown in (Figure 1).

The analysis also shows that many of the physical and humanitarian parameters describing the complexity of objects of single or compound matter in the universe are functionally related, with the classical geometrical progression being the basis of this relation:

$$a_n = a_1 g^{n-1}, \qquad (1),$$

where: a_1 and a_n are the first and following elements of the sequence; g is the denominator of progression, and n is the quantum number of evolution.

However, it should be noted that the process of destruction of simple symmetries, due to which the process of creation of objects of matter of increased complexity takes place in the points defined by the MGR of any three consecutive values forming a geometric progression (1):
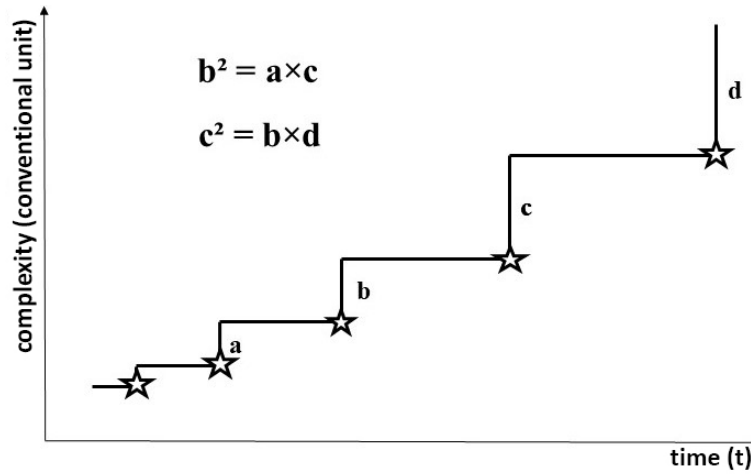
Figure 1. Model of evolutionary process of matter development

$$a_n^2 = a_{n-1}a_{n+1}, \qquad (2)$$

Universal Law of Evolution (ULE) and elementary particles

At the present time, expressions for a number of spatial characteristics of elementary particles are well known, for example, for the electron: classical radius r_e, Compton wavelength λ_k, Bohr radius r_b, de Broglie wavelength λ_b, mean square displacement of electron r_v, determined by the impact of virtual vacuum particles on the electron, and some others. Existing mathematical expressions of the electron parameters shed light on the essence and meaning of the hierarchy of a stepwise, i.e. discrete complication of existing forms of elementary matter.

The analysis of mathematical expressions describing various spatial characteristics of r_n electron

leads to a generalization which, according to (1, 2), corresponds to the status of ULE:

$$r_n = r_k\beta^{2n}, \qquad (3),$$

where: r_k and λ_κ are Compton radius and wavelength: $\lambda_\kappa = 2\pi r_k$, β is the denominator of geometrical progression determined by equations: $\beta^{2a} = \mathbf{1}$ or $e\beta = \mathbf{q}$, a is the fine-structure constant, $\mathbf{q}$ is the full electron charge, e is the electric charge of the electron, $\mathbf{n}$ is the quantum evolution number.

Table 1, based on the law defined by formula (3), presents expressions and corresponding calculated values of spatial characteristics of the electron. Full compliance of some obtained data with the already known tabular confirms the validity of the proposed expression (3) for the description of the spatial evolution of the fundamental properties of complex structures.

Table 1.

n	Parameter	cm	Parameter name
-3	$r_m = r_k\beta^{-6} = e^6/m_e c^4\hbar^2 = e^2/m_\mu c^2$	$1.5 \cdot 10^{-17}$	Classic monopole radius
-2	$r_\mu = r_k\beta^{-4} = e^4/m_e c^3\hbar = \hbar/m_\mu c$	$2.06 \cdot 10^{-15}$	Compton's monopole radius
-1	$r_e = r_k\beta^{-2} = e^2/m_e c^2$	$2.82 \cdot 10^{-13}$	Classic electron radius
0	$r_k = r_k\beta^0 = \hbar/m_e c$	$3.86 \cdot 10^{-11}$	Compton electron radius
1	$r_b = r_k\beta^2 = \hbar^2/m_e e^2$	$5.29 \cdot 10^{-9}$	Min atom size, Bohr radius
2	$r_a = r_k\beta^4 = \hbar^3 c/m_e e^4$	$7.25 \cdot 10^{-7}$	Max atom size
3	$r_M = r_k\beta^6 = \hbar^4 c^2/m_e e^6$	$9.94 \cdot 10^{-5}$	Biomolecule size

Table 1 shows that each point corresponding to the current discrete spatial parameter of the electron is a MGR of two neighboring ones:

$$r_\mu^2 = r_e r_m$$
$$r_e^2 = r_\mu r_k = r_m r_b$$
$$r_k^2 = r_e r_b = r_\mu r_a = r_M r_m$$

$$r_b^{\ 2} = r_k r_a = r_{_M} r_e$$
$$r_a^{\ 2} = r_b r_{_M}$$

Moreover, it is in these DPEs that a certain part of previous symmetries is destroyed, and the level of complexity of systems increases in proportion to the spatial size:

$$r_{_\mu} < r_{_m} < r_{_e} < r_{_k} < r_{_b} < r_{_a} < r_{_M}$$

Spatial evolution of electromagnetic forces, based on the Coulomb's law: $F_{coul} \sim 1/r^2$, is responsible for the disintegration of the seemingly simple Coulomb force into the residual, but more complex forces, determining the interatomic and intermolecular interaction. For example, such residual forces as: dipole, quadrupole, ion, metal, hydrogen, valence, covalent, Van der Waals, polarization, induction, dispersion, orientation and some others.

It should be noted that the electric force itself, defined by the law Coulomb, is also residual, because the electric charge of the electron e is β times less than the full q, which means $q = e\beta$. For this reason, it is the full charge, which is the primary source of all types of interaction of elementary particles, that determines all types of interaction of the electron with the external environment.

As a result of the process of evolution of the fundamental properties of the electron specific spatial ranges arise, when moving between which starting from the center there is a gradual complication of created objects of matter, i.e. the formation of forms from simple to more complex, which is shown in Table 2 and Fig.1.

Table 2.

Discrete range	Specific examples
$r_{-1} - r_{-2} = 2.82 \cdot 10^{-13} – 2.06 \cdot 10^{-15}$	Monopole action. K-capture. Muon.
$r_0 - r_{-1} = 3.86 \cdot 10^{-11} – 2.82 \cdot 10^{-13}$	Internal energy action – $m_e c^2$.
$r_1 - r_0 = 5.29 \cdot 10^{-9} – 3.86 \cdot 10^{-11}$	q charge action, generation of force fields.
$r_2 - r_1 = 7.25 \cdot 10^{-7} – 5.29 \cdot 10^{-9}$	Range of electron shells of atoms.
$r_3 - r_2 = 9.94 \cdot 10^{-5} – 7.25 \cdot 10^{-7}$	Water molecule, DNA, virus.
$r_4 - r_3 = 1.36 \cdot 10^{-2} – 9.94 \cdot 10^{-5}$	Bacteria, erythrocyte, cell nucleus.
$r_5 - r_4 = 1.86 \cdot 10^{-1} – 1.36 \cdot 10^{-2}$	Skin cell, large bacteria, amoeba.
$r_6 - r_5 = 2.55 \cdot 10^{1} – 1.86 \cdot 10^{-1}$	Ant, chicken egg.
$r_7 - r_6 = 3.49 \cdot 10^{3} – 2.55 \cdot 10^{1}$	Human

Electron and virtual vacuum particles.

Let us record (3) for $n = -1/2$: $r_{-1/2} = r_v = r_k/\beta$, (4). Expression (4) shows that with the accuracy to a slightly changing logarithm it coincides with the known expression for the standard square shift of r_v electron rv at its interaction with the field of virtual vacuum photons (Lambovsky shift) [2]. Let us add that r_v is related to other major spatial characteristics of the electron by the following MGR:

$$r_v^{\ 2} = r_k \cdot r_e.$$

ULE and types of matter in the Universe.

Modern information about the distribution of matter in the Universe, which has already become standard, shows that the main global types of matter are in approximately the following percentage ranges: real matter M_o=4÷6, dark matter M_{dm}=18÷24, dark energy M_{de}=68÷75, but ongoing expert assessments and scientific calculations of these values in recent years show that their results are increasingly seeking their MGR:

$$M_{dm}^{\ 2} = M_o \cdot M_{de}.$$

ULE – Universe and Human.

It is known that the **min** mass of an object in the Universe is $m_{mu} \sim 10^{-48}$ g, nd the mass of the whole Universe is $m_u \sim 10^{56}$ g, while the mass of living matter in the Universe-Human is $m_p \sim 7 \cdot 10^4$ r. he values of the above masses correspond to MGR:

$$m_p^{\,2} = m_{mu} \cdot m_u.$$

Since the mass of a human exactly occupies its MGR relative to the limit parameters of the Universe, it is fair to conclude that the evaluation of the mass of the Universe as a whole as $m_u = 10^{56}$g. s quite realistic. If it is so, it is reasonable and logical to suppose that the size of a human being should correspond to their MGR as well.

It is common knowledge that **min** size of an object in the Universe is $r_{mo} = 10^{-33}$ cm, size of the Universe is $r_u = 10^{37}$ cm, medium size of a Human is $r_p = 1{,}6 \cdot 10^2$ cm. The values of the above sizes correspond to MGR:

$$r_p^{\,2} = r_{mo} \cdot r_u, \tag{5}$$

However, modern astrophysics recognize the size of the Universe equal to $r_u = 10^{27}$ cm, which is 10^{10} раз меньше указанного в (5). times less than indicated in (5). This contradiction does not correspond to the ULE, which requires that the size of the universe corresponds to the value specified in (5), so the realistic size of the universe is $r_u = 10^{37}$, cm [3; 4].

ULE and some biochemical parameters of humans.

DNA, blood and exhaled air (excluding trace amounts of other gases) are the most important components of living matter in the Universe [5].

Genes in DNA, in (%): genes encoding proteins $G_{cp} = 2 \div 5$, repeating genes $G_{rs} = 20 \div 30$, genes not encoding proteins $G_{ep} = 70 \div 80$, their values meet MGR:

$$G_{rs}^{\,2} = G_{cp} \cdot G_{ep}.$$

Forminal elements of blood, (unit/mm³): leukocytes $k_l = 8 \cdot 10^3$, platelets $k_p = 3 \cdot 10^5$, erythrocytes $k_e = 5 \cdot 10^6$, their values meet MGR:

$$k_p^{\,2} = k_l \cdot k_e.$$

Exhaled air composition, without impurities, in (%): CO$_2$ – carbon dioxide $g_c = 2 \div 4$, **O$_2$** – oxygen $g_o = 16 \div 17$, **N$_2$** – nitrogen $g_{ng} = 74 \div 75$, their values meet MGR:

$$g_o^{\,2} = g_c \cdot g_{ng}.$$

$$a_n^{\,2} = a_{n-1} \cdot a_{n+1}$$
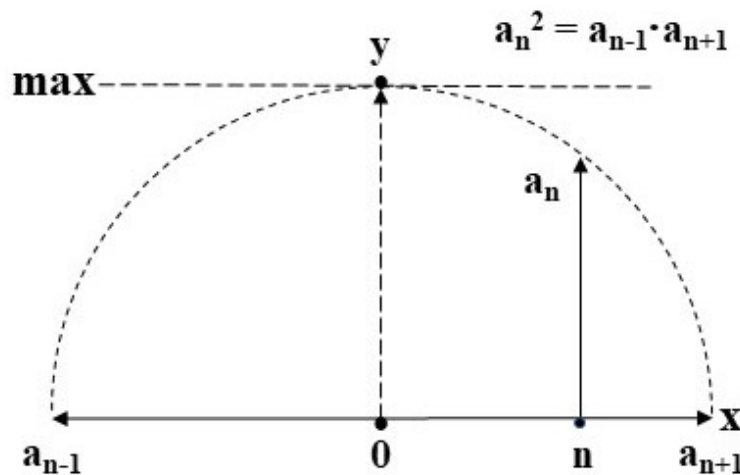
Figure 2. Graphic representation of the MGR

ULE and fundamental forces.

Assuming that strong and weak interactions of elementary particles are types of electromagnetic interactions, it turns out that Planck point is characterized by such forces as: gravitationa $F_g = \gamma m^2/r^2$, electromagnetic $F_e = q^2/r^2$ and elastic $F_u = kr$, where:

$k = m\omega^2$. The elastic force is related to the fluctuation of internal energy of the particle. It was found that the most important fundamental forces characterizing the elementary particle activity at the Planck point are related to the MGR:

$$F_e^{\,2} = F_u \cdot F_g.$$

ULE and humanities.

Taking into account the difficulties with the units of measurement of humanities we will use relative conventional units (c.u.).

The geometric mean of two a_n двух величин a_{n-1} and a_{n+1} is clearly shown in (Fig. 2). Two terminal cases can be seen from this drawing: 1) if a_{n-1} and a_{n+1} re equal to zero, then a_n will always be equal to zero, 2) if $a_{n-1} = a_{n+1}$, then $a_n = $ **max**.

Moving on to the problems of humanities, it is impossible to pass by the fundamental problem of philosophy, in which the main question of philosophy has always been: "What is primary: matter or consciousness?" The basic question of philosophy has found its principal solution within ULE, according to which it should be recognized that in reality the basic question of philosophy is devoid of any sense, and therefore it is farfetched, because there are no contradictions between these fundamental concepts, therefore [6]:

There is a great harmony between matter and consciousness in that one exists for the sake of the existence of the other.

The very fact of existence of the concept of "matter-consciousness" is related, first of all, to the main function of its development: it is a discrete creation of objects of increasing complexity, i.e. if, looking at (Fig. 2), one connects matter to the vector a_{n-1} and consciousness to the vector a_{n+1} then a_n will be MGR, **при** when moving around the circle from the point x to the point **y** the complexity of created objects will only increase, and this reflects the process of evolution corresponding to the graph presented in (Fig. 1):

Evolution = sqrt (matter × conciousness).

This formula shows that the limit of the increasing complexity of the created objects is at the point **y** which means that at this point there is an object of **max** complexity, the role of which can play only – the Creator, which means that consciousness is not the source, the existence of everything, but it in its **max** is a powerful source of influence on this very thing. That is why the Creator knows perfectly well not only his past, not to mention his present, but his entire future.

The three of these notions also have their justification within ULE, since the present is formed from the vast experience of the past (i.e., cognition) and the conscious notions of the future on its basis. Therefore:

Present = sqrt (past × future),

which means that if notions of the future are wrong or insignificant, if experience of the past teaches nothing, the present will be primitive.

In November 2019, **Jan Todd** N Secretary General's Special Envoy for Road Safety, in his report, put the lack of sufficient training among the main causes of high mortality on the Russian roads. A broad study of the reasons for the decline in the quality of education allowed the author to draw the main conclusion that the legal culture (LC) of a person has shifted towards dogmatism [6].

It is obvious that human behavior is, among other things, regulated by legal and regulatory prescriptions (LRP) of the state and natural laws (NL).

In order to clarify the problem points, the author has been conducting an experiment-screening over the past 30 years, which was intended to get accurate answers to many questions, two of which are directly related to ULE:

1. How to drive correctly at an intersection controlled by traffic lights?

2. What is democracy?

Despite the fact that the participants were from all social strata of the country, it was not possible to get an exact answer to these questions. This is explained by the fact that all participants in formulating their answers were guided mainly by the existing LRPs, while ignoring NL, which indicates the existence of legal dogmatism.

In order to determine the necessary and sufficient basic level determining the ratio between NL and LRP, on which the Human LC should be based, and thus the corresponding training of a person, the extrapolation of the discussed problem within ULE, according to which:

$$LC = sqrt\,(NL \times LRP).$$

This formula shows that LC inevitably implies that a person should know not only LRP, but also NL, and LC corresponds to a high level if the volume of human knowledge of NL and LRP is balanced and as much as possible. Figure 1 shows that if a smaller vector a_{n+1}, is connected to NL, LC is not high and has a dogmatic shift to the right.

Regarding the second question, we can see a situation where there is a collision of Personal Rights (PR) and State Rights (SR). In this case, the level of democracy (D) also finds its description within the ULE:

$$D = sqrt\,(SR \times PR).$$

It is clear from this formula that any destruction of the balance between state and personal rights always leads to a decline in the level of democracy.

Taking into account the significant list of the above mentioned examples of ULE effect in absolutely different spheres of existence of matter and consciousness, the fundamental fact that this Law exists and is quite universal can be considered proved. The basis of this universality is provided by the principle of goal setting, without which neither the Universe nor the Consciousness can exist.

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ON THE THEORY OF THREE PHOTONIC LINEAR CIRCULAR DICHROISM IN A HOLE-CONDUCTION SEMICONDUCTOR

Abstract. In this work the matrix elements of three-photon optical transitions accompanied between the subbands of the valence band of the semiconductor of cubic symmetry was calculated. In this case, the contribution of the simultaneous three-photon interaction to the total matrix element of the three-photon optical transitions was taken into account and it was shown that this contribution depends both on the sign and the numerical value of the parameter in front of the effective wave Hamiltonian term that is cubic in terms of the wave vector of holes.

Keywords: matrix element, effective Hamiltonian, holes, photon.
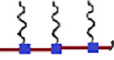
When linearly and circularly polarized light is absorbed, multi-quantum optical transitions through virtual electronic states are allowed, which are found both in the valence and conduction bands and in the zones located far from them. According to the law of conservation of the angular momentum of current carriers, the physical nature of optical transitions depends on the degree of polarization of light. In particular, with photon absorption of circularly polarized light, photoexcited carriers will have nonzero angular momenta. So that the following photons will interact with optically oriented current carriers. According to the rule of choosing the optical transition under consideration for the projection of the moments of the current carriers relative to the wave vector of the photon, the probability of two and three-photon optical transitions will depend on both the frequency and the degree of polarization of light. The latter leads to the identification of linearly circular dichroism of light absorption. This is true when the dependence of the absorption of polarized light on the anisotropy of the semiconductor crystal is not taken into account.

Note that the research of some optical parameters of a semiconductor, for example, when calculating a single and multiphoton absorption coefficient of polarized radiation or a polarization-dependent photocurrent (see, for example, [7–10]), it is necessary to calculate the matrix elements of the optical transitions under consideration. Therefore, we will further analyze the matrix elements of optical transitions for specific cases.

Now we turn to the analysis of three-photon optical transitions between the subbands of heavy and light holes. The matrix elements of all types of three-photon optical transitions are expressed as

$$M^{(3)}_{m\vec{k},m'\vec{k}} = M^{(3)}_{m,m'} = \sum_{m''',m''=\pm 1/2,\pm 3/2} \left(\frac{M^{(1)}_{m,m'''}M^{(1)}_{m''',m''}M^{(1)}_{m'',m'}}{\left(E_{m'''\vec{k}}-E_{m'\vec{k}}-\hbar\omega\right)\left(E_{m''\vec{k}}-E_{m'\vec{k}}-\hbar\omega\right)} + \right.$$
$$\left. + \frac{M^{(1)}_{m,m''}M^{(2)}_{m'',m'}}{\left(E_{m''\vec{k}}-E_{m'\vec{k}}-2\hbar\omega\right)} + \frac{M^{(2)}_{m,m''}M^{(1)}_{m'',m'}}{\left(E_{m''\vec{k}}-E_{m'\vec{k}}-\hbar\omega\right)} + \left(\frac{eA_0}{c\hbar}\right)^3 \left[H^{(3)}_{\Gamma_6}(\vec{e}')\right]_{m,m'} \right), \tag{1}$$

the third term is described by a diagram ⌇⌇⌇, the second by a diagram ⌇⌇, the third by a diagram ⌇⌇⌇, the fourth by a diagram ⌇⌇, $\tilde{M}^{(3)}_{m'',m'} =$
$$= \left(\frac{eA_0}{c\hbar}\right)^3 \left[H^{(3)}_{\Gamma_6}(\vec{e}')\right]_{m,m'}, \quad H^{(N)}_{\Gamma_6}(\vec{e}') = H^{(N)}_{\Gamma_6}(\vec{k}\to\vec{e}'),$$
$H^{(N)}_{\Gamma_6}(\vec{k})$ is the effective Hamiltonian of holes in the Luttinger-Kohn representation [12–13], $N = 2,3,4$, $H^{(3)}_{\Gamma_6}(\vec{k})$ is the term cubic in the wave vector $(\vec{k})$ of holes $H^{(N)}_{\Gamma_6}(\vec{k})$. In particular, for cubic symmetry semiconductors $H^{(3)} = D'\vec{J}\cdot\vec{K}$, $K_\alpha = k_\alpha\left(k^2_{\alpha+1}+k^2_{\alpha+2}\right)$, J_α is the matrix of the angular momentum operator in the Γ_8 representation [12–13], D' is the band parameter of the semiconductor, for example, for p-GaAs $D' = 3,9\times 10^{-23}\,eV\cdot sm^3$.

We note here that the contribution of the simultaneous absorption of three photons to the coefficient of light absorption or linearly circular dichroism was not researched in [2, 3, 7–11], i.e. the last term in (1) was neglected.

If we consider the optical transitions occurring by the absorption of three separate photons described by the diagram ⌇⌇⌇, then the polarization dependence of the matrix element of the optical transition of the type $|+3/2\rangle \to |m\rangle \to |m'\rangle \to |+1/2\rangle$ is expressed as $2\sqrt{3}\left(\frac{eA_0}{c\hbar}\right)^3\frac{(Bk)^3}{(\hbar\omega)^2}e'_+\left(4|e_{z'}|^2-\frac{3}{8}|e'_+|^2\right)$

where, according to the numbers of intermediate states $|m\rangle, |m'\rangle$ summation is performed. The matrix element of a three-photon optical transition of the type ⌇⌇ where one photon is first absorbed and then two photons are simultaneously absorbed

$$-\frac{\sqrt{3}}{2}\left(\frac{eA_0}{c\hbar}\right)^3\frac{B^2k}{\hbar\omega}e'_+ \times \left\{\left[2(\frac{A}{B}-1)+2e'^2_z+\frac{1}{2}e'^2_\perp\right]-4(\frac{A}{B}-1)e'^2_z\right\},$$

the matrix element of the type ⌇⌇⌇ optical transition where two photons are first absorbed simultaneously, the matrix element of an optical transition of the type and then one photon is absorbed is determined in a similar way. The sum of the matrix elements of the last two transitions is expressed as

$$-\frac{\sqrt{3}}{2}\left(\frac{eA_0}{c\hbar}\right)^3\frac{B^2k}{\hbar\omega}e'_+\left(10e'^2_z-e'^2_\perp\right).$$

As a result, the polarization dependence of the sum of all three-photon optical transitions described by the diagram ⌇⌇⌇ + ⌇⌇⌇ + ⌇⌇⌇ is expressed as
$$\frac{\sqrt{3}}{2}\left(\frac{eA_0}{c\hbar}\right)^3\frac{B^2k}{\hbar\omega}e'_+\left[\left(-10e'^2_z+e'^2_\perp\right)+4\frac{Bk^2}{\hbar\omega}\left(4|e_{z'}|^2-\frac{3}{8}|e'_+|^2\right)\right].$$
If we take into account the energy conservation law in three-photon optical transitions and $e'^2_\perp = |e'_+|^2$, then the last expression takes the form $-\frac{\sqrt{3}}{8}\left(\frac{eA_0}{c\hbar}\right)^3\frac{B^2k}{\hbar\omega}e'_+\left(136e'^2_z-13e'^2_\perp\right)$. Then the square of the modulus of three-photon optical transitions of the type ⌇⌇⌇ has the form

$$\left\{\left|M^{(1-1-1)}_{+1/2;+3/2}\right|^2 + \left|M^{(1-1-1)}_{-1/2;-3/2}\right|^2\right\} = \left(\frac{eA_0}{c\hbar}Bk\right)^3\frac{24}{(\hbar\omega)^4}\left\{\left|e'_+\left(4|e_{z'}|^2-\frac{3}{8}|e'_+|^2\right)\right|^2 + \left|e'_-\left(4|e_{z'}|^2-\frac{3}{8}|e'_-|^2\right)\right|^2\right\}. \tag{2}$$

After conducting angular averaging over the solid angle of the wave vector of holes, we have:

$$\left\langle \left\{ \left| M_{+1/2;+3/2}^{(1-1-1)} \right|^2 + \left| M_{-1/2;-3/2}^{(1-1-1)} \right|^2 \right\} \right\rangle_{linear\ pol} = \frac{297}{4} \left(\frac{eA_0}{c\hbar} \right)^6 B^3 \frac{1}{\hbar\omega}$$

– for linear;

$$\left\langle \left\{ \left| M_{+1/2;+3/2}^{(1-1-1)} \right|^2 + \left| M_{-1/2;-3/2}^{(1-1-1)} \right|^2 \right\} \right\rangle_{circ.\ pol.} = \frac{405}{16} \left(\frac{eA_0}{c\hbar} \right)^6 \frac{B^3}{\hbar\omega}$$

– for circular polarization.

From the last relations it can be seen that the co-efficient of three-photon linear circular dichroism, when the photons are absorbed separately, is $\eta_{\pm1/2;\pm3/2}^{(1-1-1)} = 44/15$.

The square of the polarization modulus of the total matrix elements of optical transitions of the type

takes the form

$$\sum_{m=\pm3/2;m'=\pm1/2} \left| M_{m,m'}^{(3)} \right|^2 = \frac{3}{4} \left(\frac{eA_0}{c\hbar} \right)^6 \left(\frac{B^2 k}{\hbar\omega} \right)^2 \left\{ e_\perp'^2 \left[\left(-10 e_z'^2 + e_\perp'^2 \right) - 6 \left(4 \left| e_{z'} \right|^2 - \frac{3}{8} \left| e_\perp' \right|^2 \right) \right]^2 + \right.$$
$$\left. + 4 \frac{\hbar\omega}{B^2 k} D' \left(34 e_\perp'^2 e_z'^4 - \frac{13}{4} e_\perp'^4 e_z'^2 \right) + 4 \left(\frac{\hbar\omega D'}{B^2 k} \right)^2 \left(\left| e_\perp' \right|^2 e_z'^4 + \left| e_\perp' \right|^2 e_y'^2 e_x'^2 \right) \right\}. \quad (3)$$

Then, averaging the last relation over the wave vector of holes, we obtain:

$$\left\langle \sum_{m=\pm3/2;m'=\pm1/2} \left| M_{m,m'}^{(3)} \right|^2 \right\rangle_{linear} = \left(\frac{eA_0}{c\hbar} \right)^6 \left(\frac{B^2 k}{\hbar\omega} \right)^2 \left[21,5 + 4,9 \frac{\hbar\omega}{B^2 k} D' + 0,5 \left(\frac{\hbar\omega D'}{B^2 k} \right)^2 \right], \quad (4)$$

for linear;

$$\left\langle \sum_{m=\pm3/2;m'=\pm1/2} \left| M_{m,m'}^{(3)} \right|^2 \right\rangle_{circ} = \left(\frac{eA_0}{c\hbar} \right)^6 \left(\frac{B^2 k}{\hbar\omega} \right)^2 \left[22,5 + 7,8 \frac{\hbar\omega}{B^2 k} D' + 0,49 \left(\frac{\hbar\omega D'}{B^2 k} \right)^2 \right] \quad (5)$$
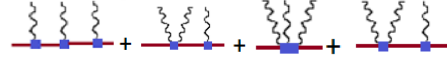
for circular polarization.

Thus, the coefficient of linearly circular dichroism of three-photon absorption, where the simultaneous absorption of three photons is taken into account, depends on the sign and numerical value of the band parameter D'.

For example, for p-GaAs we assume that it $D' = 3,9 \times 10^{-23}\ eV \cdot sm^3$ is positive [13], then for the following values: $\lambda = 10.6\ mkm$ – is the wavelength of light, $B = 5.66 \times 10^{-38}\ J \cdot m^2$ the ratio $\frac{\hbar\omega}{B^2 k} D' = 1,3 \times 10^{-2}$ and contribution of taking into account the simultaneous absorption of three-photons in three-photon linear circular dichroism (without taking into account the effect of coherent saturation) is no more than 3%.

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ON THE THEORY OF FOUR PHOTONIC LINEAR CIRCULAR DICHROISM IN A HOLE-CONDUCTION SEMICONDUCTOR

Abstract. In this work the matrix elements of four photonic optical transitions accompanied between the subbands of the valence band of the cubic symmetry semiconductor were calculated, where the contribution of the simultaneous three photon interactions to the total matrix element of the four photonic optical transitions was taken into account and it was shown that this contribution depends on both the sign and the numerical value of the parameter in front of the cubic by the wave vector of holes, the term in the effective Hamiltonian.
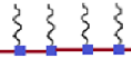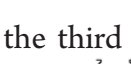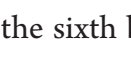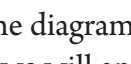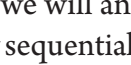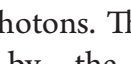
Keywords: four photon optical transitions, matrix element, effective Hamiltonian, holes, photon.

Although single-photon (linear in intensity) absorption of polarized light in semiconductors, due to optical transitions between the subbands of light and high holes of the valence band, has been researchd both theoretically and experimentally for a long time [1; 2], but the question of linear-circular dichroism (see, for example, [1–7]) of four photon absorption of light, taking into account the simultaneous absorption of three photon, remains open. Therefore, we consider below four photon absorption of polarized light in cubic symmetry semiconductors, due to direct optical transitions between light and high hole subzones, where, differ [1–7], we take into account the simultaneous absorption of three photons. Next, we will calculate the four-photon matrix element of optical transitions between the subbands of high and light holes in the valence band of the semiconductor, which is expressed by the ratio

$$M_{m\vec{k},m'\vec{k}}^{(4)} = M_{m,m'}^{(4)} = \sum_{m''',m''=\pm 1/2,\pm 3/2} \left(\frac{M_{m,\tilde{m}}^{(1)} M_{\tilde{m},m'''}^{(1)} M_{m''',m''}^{(1)} M_{m'',m'}^{(1)}}{\left(E_{\tilde{m}\vec{k}} - E_{m'\vec{k}} - \hbar\omega\right)\left(E_{m'''\vec{k}} - E_{m'\vec{k}} - \hbar\omega\right)\left(E_{m''\vec{k}} - E_{m'\vec{k}} - \hbar\omega\right)} + \right.$$

$$+ \frac{M_{m',m'''}^{(1)} M_{m''',m''}^{(1)} M_{m'',m'}^{(2)}}{\left(E_{m'''\vec{k}} - E_{m'\vec{k}} - 3\hbar\omega\right)\left(E_{m''\vec{k}} - E_{m'\vec{k}} - 2\hbar\omega\right)} + \frac{M_{m',m'''}^{(1)} M_{m''',m''}^{(2)} M_{m'',m'}^{(1)}}{\left(E_{m'''\vec{k}} - E_{m'\vec{k}} - 3\hbar\omega\right)\left(E_{m''\vec{k}} - E_{m'\vec{k}} - \hbar\omega\right)} +$$

$$+ \frac{M_{m',m'''}^{(2)} M_{m''',m''}^{(1)} M_{m'',m'}^{(1)}}{\left(E_{m''\vec{k}} - E_{m'\vec{k}} - 2\hbar\omega\right)\left(E_{m''\vec{k}} - E_{m'\vec{k}} - \hbar\omega\right)} + \frac{M_{m,m''}^{(2)} M_{m'',m'}^{(2)}}{\left(E_{m''\vec{k}} - E_{m'\vec{k}} - 2\hbar\omega\right)} + \frac{\tilde{M}_{m,m''}^{(3)} M_{m'',m'}^{(1)}}{E_{m'\vec{k}} - E_{m'\vec{k}} - \hbar\omega} +$$

$$+\frac{M^{(1)}_{m,m''}\tilde{M}^{(3)}_{m'',m'}}{E_{m''\vec{k}}-E_{m'\vec{k}}-3\hbar\omega}, \qquad (1)$$

where the third term is described by the Feynman diagram ⌇⌇⌇, the second by the diagram ⌇⌇⌇, the third by the diagram ⌇⌇, the fourth diagram ⌇⌇, the fifth by the diagram ⌇⌇, the sixth by the diagram ⌇⌇, the seventh by the diagram ⌇⌇.

Next, we will analyze optical transitions accompanied by sequential (non-simultaneous) absorption of four photons. These optical transitions are described by the following single diagram: $\left|+3/2\right\rangle\rightarrow\left|m\right\rangle,\ \rightarrow\left|m'\right\rangle\rightarrow\left|m''\right\rangle\rightarrow\left|+1/2\right\rangle$, where $\rightarrow$ schematically depicts a single-photon transition $m'',m',m=\pm3/2,\pm1/2$. Then, in the Luttinger-Kohn approximation, the following optical transitions are allowed, occurring between the subbands of light and high holes of a cubic symmetry semiconductor, corresponding to these transitions, are expressed as

$$-\frac{M^{(1)}_{+1/2;+3/2}M^{(1)}_{+3/2;+3/2}}{6(\hbar\omega)^3}\left|M^{(1)}_{+3/2;+3/2}\right|^2,$$

$$\frac{M^{(1)}_{+1/2;+1/2}M^{(1)}_{+1/2;+3/2}}{2(\hbar\omega)^3}\left|M^{(1)}_{+3/2;+3/2}\right|^2,$$

$$\frac{M^{(1)}_{+1/2;+3/2}M^{(1)}_{+3/2;+3/2}}{6(\hbar\omega)^3}\left|M^{(1)}_{+3/2;+1/2}\right|^2,$$

$$\frac{M^{(1)}_{+1/2;+3/2}M^{(1)}_{+3/2;+3/2}}{2(\hbar\omega)^3}\left|M^{(1)}_{+1/2;+1/2}\right|^2,$$

$$\frac{M^{(1)}_{+1/2;+3/2}M^{(1)}_{+3/2;+3/2}}{18(\hbar\omega)^3}\left|M^{(1)}_{+3/2;+1/2}\right|^2,$$

$$-\frac{M^{(1)}_{+1/2;+1/2}M^{(1)}_{+1/2;+3/2}}{6(\hbar\omega)^3}\left|M^{(1)}_{+3/2;+1/2}\right|^2, \qquad (2)$$

$$-\frac{M^{(1)}_{+1/2;+1/2}M^{(1)}_{+1/2;+3/2}}{18(\hbar\omega)^3}\left|M^{(1)}_{+3/2;+1/2}\right|^2,$$

$$\frac{M^{(1)}_{+1/2;+1/2}M^{(1)}_{+1/2;+3/2}}{6(\hbar\omega)^3}\left|M^{(1)}_{+1/2;+1/2}\right|^2,$$

the corresponding energy conservation law is determined by the Dirac function: $\delta\left(E_{lh}\left(\vec{k}\right)-E_{hh}\left(\vec{k}\right)-4\hbar\omega\right)$, $E_{lh}\left(\vec{k}\right)$ and $E_{hh}\left(\vec{k}\right)$ are the energy spectrum of light and high holes, $M^{(1)}_{m',m}$ is the matrix element of a single-photon optical transition of the type $\left|m\right\rangle\rightarrow\left|m'\right\rangle$. Then the polarization dependence of the sum of these matrix elements is determined by the relation

$$\left(\frac{eA_0}{c\hbar}Bk\right)^4\frac{\sqrt{3}e'_z e'_-}{18(\hbar\omega)^3}\Bigg\{\left(6(\frac{A}{B}-1)+2e'^2_\perp\right)^2\left(4(\frac{A}{B}-1)+\frac{5}{6}e'^2_\perp+6e'^2_z\right)-3\left(2(\frac{A}{B}-1)+\frac{1}{2}e'^2_\perp+2e'^2_z\right)^2\times$$

$$\times\left(4(\frac{A}{B}-1)+\frac{3}{2}e'^2_\perp-2e'^2_z\right)+e'^2_z e'^2_\perp\left(2e'^2_\perp-24e'^2_z\right)\Bigg\}, \qquad (3)$$

where $e'_\alpha\ (\alpha=x,y,z)-$ is the polarization vector of the electromagnetic wave in the Cartesian coordinate system, where the Oz axis is chosen in the direction of the wave vector of the holes. Expressions for optical transitions $\left|-3/2\right\rangle\rightarrow\left|m\right\rangle\rightarrow$ $\rightarrow\left|m'\right\rangle\rightarrow\left|m''\right\rangle\rightarrow\left|+1/2\right\rangle$ are defined in a similar way.

The matrix elements corresponding to the interband optical transitions of the type $\left|\pm3/2\right\rangle\rightarrow\left|m\right\rangle$ $\rightarrow\left|m'\right\rangle\rightarrow\left|m''\right\rangle\rightarrow\left|\mp1/2\right\rangle$ are equal to zero, i.e. such

transitions are forbidden in the Lattiger-Kohn approximation.

Note that the sum of the squares of the matrix elements of the interband optical transitions due to the absorption of four separate photons, as well as for optical transitions of the type:

$$\left|+3/2\right\rangle\rightarrow\left|m'\right\rangle\rightarrow\left|m''\right\rangle\Rightarrow\left|+1/2\right\rangle,$$

$$\left|+3/2\right\rangle\rightarrow\left|m'\right\rangle\Rightarrow\left|m''\right\rangle\rightarrow\left|+1/2\right\rangle,$$

$$\left|+3/2\right\rangle\rightarrow\left|m'\right\rangle\Rightarrow\left|m'''\right\rangle\rightarrow\left|-1/2\right\rangle,$$

$$|+3/2\rangle \Rightarrow |m\rangle \Rightarrow |+1/2\rangle$$

$$|+3/2\rangle \Rightarrow |m'\rangle \to |m''\rangle \to |+1/2\rangle$$

$|+3/2\rangle \Rightarrow |m\rangle \Rightarrow |-1/2\rangle$ are given in [7–10], where $\to$ schematically depicts the absorption of one photon, and $\Rightarrow$ depicts the simultaneous absorption of two photons.

Then, squaring the modulus of the sum of the matrix elements of all the optical transitions under consideration and averaging over the solid angles of the wave vector of the holes, we can determine both the spectral and temperature dependences of the light absorption coefficient and the linearly circular absorption dichroism in a semiconductor of cubic symmetry. Below we present the numerical values of the linear-circular dichroism coefficient for individual transitions. In particular, for the above transitions, we have the following results:

$$\left|M_{\pm 1/2,\pm 3/2}^{(1-1-2;1-2-1;2-1-1)}\right|^2 = \frac{327232}{945}\left(\frac{eA_0}{c\hbar}\right)^8\left(\frac{B^2}{\hbar\omega}\right)^2 \quad \text{and}$$

$$\left|M_{\mp 1/2,\pm 3/2}^{(1-1-2;1-2-1;2-1-1)}\right|^2 = \frac{4352}{135}\left(\frac{eA_0}{c\hbar}\right)^8\left(\frac{B^2}{\hbar\omega}\right)^2 \quad \text{for linear,}$$

$$\left|M_{\pm 1/2,\pm 3/2}^{(1-1-2;1-2-1;2-1-1)}\right|^2 = \frac{4304}{189}\left(\frac{eA_0}{c\hbar}\right)^8\left(\frac{B^2}{\hbar\omega}\right)^2$$

$$\left|M_{\mp 1/2,\pm 3/2}^{(1-1-2;1-2-1;2-1-1)}\right|^2 = \frac{4496}{135}\left(\frac{eA_0}{c\hbar}\right)^8\times\left(\frac{B^2}{\hbar\omega}\right)^2 - \text{for cir-}$$

cular polarization. The linear-circular dichroism coefficient (i.e., the ratio of the probability for linear polarization to the probability for circular polarization) for these transitions is equal to $\eta_{\mp 1/2,\pm 3/2}^{(1-1-2;1-2-1;2-1-1)} = \frac{272}{281}$ and $\eta_{\pm 1/2,\pm 3/2}^{(1-1-2;1-2-1;2-1-1)} = \frac{1345}{20452}$, where the superscript describes the order and number of absorbed photons.

The linear-circular dichroism coefficient for optical transitions of the type ⌇⌇ is equal to $\eta^{(2+2)} = \frac{64}{25}$. For this transition, the orientation of the moments of photoexcited holes occurs more intensively than the alignment of their momenta.

We consider four photonic optical transitions accompanied by the simultaneous absorption of three photons. In particular, in the Luttinger-Kohn approximation, a matrix element of an optical transition of the type ⌇⌇⌇ :

$$\frac{M_{+1/2;+1/2}^{(3)} - M_{+3/2;+3/2}^{(3)}}{3\hbar\omega}M_{+1/2;+3/2}^{(1)} + \frac{M_{+1/2;+1/2}^{(1)} - M_{+3/2;+3/2}^{(1)}}{\hbar\omega}M_{+1/2;+3/2}^{(3)} =$$

$$= \left(\frac{eA_0}{c\hbar}\right)^4 D'k\frac{2}{\sqrt{3}\hbar\omega}Be_z'\left\{e_x'\left(6e_z'^2 + 7e_y'^2 - e_x'^2\right) + ie_y'\left(7e_x'^2 + 6e_z'^2 - e_y'^2\right)\right\}, \tag{4}$$

and for the optical transition type ⌇⌇⌇

$$\frac{M_{-1/2;+1/2}^{(3)}M_{+1/2;+3/2}^{(1)}}{\left(E_{lh} - E_{hh} - \hbar\omega\right)} = \left(\frac{eA_0}{c\hbar}\right)^4 Bk_\omega D'\frac{2\left(\varepsilon_x - i\varepsilon_y\right)e_-'}{\sqrt{3}\hbar\omega}, \tag{5}$$

where k_ω the wave vector of holes in the final state, determined from the conservation law corresponding to the optical transition under consideration.

The square of the modulus of the total matrix elements of optical transitions of the type ⌇⌇⌇ + ⌇⌇⌇ + ⌇⌇⌇ + ⌇⌇⌇ takes the form

$$\sum_{m=\pm 3/2;m'=\pm 1/2}\left|M_{m,m'}^{(4)}\right|^2 = \frac{3}{4}\left(\frac{eA_0}{c\hbar}\right)^6\left(\frac{B^2k}{\hbar\omega}\right)^2\left\{e_\perp'^2\left[\left(-10e_z'^2 + e_\perp'^2\right) - 6\left(4|e_{z'}|^2 - \frac{3}{8}|e_\perp'|^2\right)\right]^2 + \right.$$
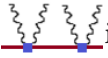
$$\left. + 4\frac{\hbar\omega}{B^2k}D'\left(34e_\perp'^2 e_z'^4 - \frac{13}{4}e_\perp'^4 e_z'^2\right) + 4\left(\frac{\hbar\omega D'}{B^2k}\right)^2\left(|e_\perp'|^2 e_z'^4 + |e_\perp'|^2 e_y'^2 e_x'^2\right)\right\}. \tag{6}$$
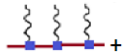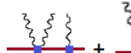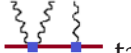
Then, averaging the last relation over the wave vector of holes, we obtain:

$$\left\langle \sum_{m=\pm 3/2;\, m'=\pm 1/2} \left| M^{(4)}_{m,m'} \right|^2 \right\rangle_{linear} = \left(\frac{eA_0}{c\hbar} \right)^6 \left(\frac{B^2 k}{\hbar \omega} \right)^2 \left[21,5 + 4,9 \frac{\hbar \omega}{B^2 k} D' + 0,5 \left(\frac{\hbar \omega D'}{B^2 k} \right)^2 \right], \qquad (7)$$

for linear,

$$\left\langle \sum_{m=\pm 3/2;\, m'=\pm 1/2} \left| M^{(4)}_{m,m'} \right|^2 \right\rangle_{circ} = \left(\frac{eA_0}{c\hbar} \right)^6 \left(\frac{B^2 k}{\hbar \omega} \right)^2 \left[22,5 + 7,8 \frac{\hbar \omega}{B^2 k} D' + 0,49 \left(\frac{\hbar \omega D'}{B^2 k} \right)^2 \right] \qquad (8)$$

for circular polarization.

In conclusion, we note that the coefficient of linearly circular dichroism of four-photon absorption, where the simultaneous absorption of three photons is taken into account, depends on the band parameter D'. For example, for p-GaAs we assume that $D' = 3,9 \times 10^{-23}\, eV \cdot sm^3$ it is positive, then for the following values: $\lambda = 10.6\, mkm$ is the wavelength of light, $B = 5.66 \times 10^{-38}\, J \cdot m^2$, then the ratio $\frac{\hbar \omega}{B^2 k} D' = 1,3 \times 10^{-2}$ and contribution of taking into account the simultaneous absorption of three-photons in four-photon linear circular dichroism is not more than 6%.

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Section 9. Philology and linguistics

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EXAMPLES OF AZERBAIJANI LITERATURE STUDIES IN FRENCH LITERATURE

Abstract. Interest in prominent figures of the East, literary examples and historical events in this region became one of the main areas of literary research in world literature, which gave impetus to the creation of great works of art, especially in the literature of European peoples. Starting from the 18th century, French literature showed great interest in oriental subjects: Madeleine de Scuderi, Jean Racine, Charles Louis de Montesquieu, Donnie Didro, Jean-Jacques Rousseau, Francois Marie Aryu Voltaire, and in the 19th century Victor Hugo, Georges Sand, Alexander Dumas, Jules Verne. Literary figures such as Theophilus Gauthier, Alfons de Lamartine, Lille de Licont, wrote poems, novels and essays on this inexhaustible topic. In the twentieth century, this tradition was continued in French literature, and in the works of famous writers of that time, Henri Mass, Pierre Lotti, Louis Aragon, Georges Friel, Marcel Egreto, Heydar Bammat, a special place was occupied by oriental themes, valuable literary examples were created. The influence of these examples on French literature was studied. Scientific objectivity, comprehensive involvement of facts and information in the problem, comparative analysis, a critical analytical method, a causal method in studying realities were widely used in studying the problem, and the latest achievements of the country's literary criticism were taken into account.

Keywords: Avesta, Nizami Ganjavi, Keroglu, Anketil-Duperron, Augen Levek, Marie Arua Voltaire, Henri Mass, Louis Aragon, Rauf Ismayilov, Asgar Zeynalov.

Introduction

The study of oriental motifs in French literature began to develop as a new scientific direction in Azerbaijan, mainly during the years of independence, when scientific research was free from the influence of Soviet ideology. Of particular note are the services of Azerbaijani scientists Rauf Ismayilov, Asgar Zeynalov, Asgar Aliyev, Elmira Farajullayeva, Asgar Sarkroglu, Aziz Gozalov in this area.

Professor Rauf Ismayilov first improved his work "Azerbaijan-French Literary Relations" (1983), written in Russian, and reprinted it in 2001 in a larger volume. "Nizami in French sources" (1991), "Prophetic thinker and poet of Azerbaijan" (2004), "East in French literature" (1996), "In the works of East Voltaire" (2001), "Victor Hugo" 2001), "It was a century…" (2010), the works of Elmira Farajullaeva" Oriental themes in the works of George Sand "and

the author's monograph" Oriental motifs in French literature of the XIX century "are important in this regard.

Looking at the studies of Azerbaijani researchers, it becomes clear that one of the most frequently used oriental themes by French writers and orientalists is Avesta. Therefore, the views of French writers and scientists on the "Avesta" are found in the studies of R. Ismayilov, A. Sarkroglu and A. Zeynalov. As you know, the Avesta is the holy book of monotheism religion, created by Zoroaster, who lived in the second half of the seventh century BC. and at the beginning of the fifth century BC This religion spread to modern Iran, Azerbaijan, Central Asia and India, and its fans were called fire worshipers.

First of all, it is necessary to comment on the first edition of the Avesta in French. R. Ismayilov writes about the publication of the Avesta in French that "… in the second half of the 18th century, European Orientalists had no idea about the Avesta. Only in 1771 did the young French orientalist Anketil-Duperron acquainted European scholars with the French translation of the Avesta. The French translation of the Avesta parts, obtained in India, has opened a new page in world oriental studies for studying the ancient religious and philosophical views of Azerbaijan, Persia and other Middle Eastern peoples" [8].

It should be noted that the importance of translating the French scientist Anketil-Duperro and studying the Avesta into French was first commented by Academician Barthold [1]. A. Sarkroglu also writes about the publication of this magnificent monument of the East, that the first publisher of Avesta was the famous orientalist Anketil-Duperron. According to A. Sarkroglu, Anketil-Duperro, who devoted his life to the study of Oriental languages, received an ancient manuscript in Zanda at a young age, and since then he became interested in studying Zanda and Sanskrit … In 1755, his friends sent him to India by ship Shark. they say goodbye. Duperron meets the Gavur tribe here and makes contact with the infidels. Thus, he caught the origin of the tribe, the

scriptures and sayings about ancient religious books, and 8 years later (in 1762) he brought with him to France the manuscripts he had collected … The work of Duperro, who began working on his own manuscripts, paid off. As a result, his book Zand-Avesta was published in 1771 [2]. This book, which attracted the attention of the French literary community, was published for the second time in 1787 in Paris. According to A. Sarkroglu, this book laid the foundation for the study of the Avesta in France. According to the Zand-Avesta book, a school for the study of the Zand language and the ancient Iranian language was created in France. This work was later continued and developed by the famous French orientalists Clicker, Burnouf, Olzazen and others.

However, this does not mean that Europe first met the Zand-Avesta on this date, that is, in 1771. Searches lead to this acquaintance. The article by A. Sarkroglu "Avesta and the culture of the ancient world" found its way [3].

The views of Odzhen Levekin about Alexander the Great, published in Russian in Moscow in 1984, are more sympathetic and surprising because they are objective. O. Levek writes: "If Aristotle was a consistent Platonist, then Zoroaster, who ran the academy, would inspire admiration for his student. Although Aristotle praised the teachings of the Avesta, in the national interest of the Greeks, he did not want the teachings of this priest to influence Alexander. Therefore, when Alexander later went to Asia, he did not know about the "Avesta" of Zoroaster and was only interested in usurping those places" [2]. In addition to confirming the fact that he was an impartial researcher, this should also be seen as a prime example of the influence of the Avesta on the French literary environment. From the available information, we can conclude and agree with A. Sarkroglu that the Avesta was widely distributed in Europe BC, studied as a religious and philosophical work and for many centuries and greatly influenced the work of the greatest philosophers and poets of Europe. Along with all this, we need to focus on one problem. Most studies show that Europe was the first

to read this magnificent work of the East, translated by Anketil-Duperro. However, studies show that there is a different opinion.

For several centuries in French literature, one of the most frequently asked topics about the East has been the work of the great Azerbaijani poet and thinker Nizami Ganjavi. Devoting the 40th anniversary of Ganjavi's literary heritage to French sources, Asgar Sarkaroglu's monograph Nizami Ganjavi in French Sources (1991) and The Prophetic Thinker and Poet of Azerbaijan (2004) prove the importance of this topic in French literary criticism. According to Asgar Sarkroglu, the first European Orientalists who were engaged in the life and work of the Azerbaijani poet Ganjavi Nizami were the French. They publish articles about the Azerbaijani poet from the 17th century. French Orientalists Barthelemy De Erbelo, Antoine Gallan, Sylvester de Sacy, Jules Maul, Jean Darmstetter, Lucien Beauvais, Alfons Russo, S. Russo, Teofil Gauthier, Rone Patry, E. Bloch, Georges Frilli, Henri Mass, Louis Sparges he introduced the French great Azerbaijani poet with special respect, Henri Masset translated the poetry of the poet "Khosrov and Shirin" and Clleromble "Seven Beauties" into French [4].

First of all, it should be noted that the French writer, unlike most of his other compatriots, presents Nizami to French readers as an Azerbaijani poet. Even Louis Aragon writes that the people who gave such a genius as Nizami Ganjavi (grandson of Ilyas Yusif oglu Zaki Muayyaddin) deserve all respect. "Hamsa" by Nizami is more widespread in the world than verses written in Latin and Greek [8].

It should be noted that the question of the social and literary environment in which Nizami grew up was also of interest to French writers and researchers. We read in the monograph of R. Ismayilov: "Referring to historical sources, L. Aragon writes that Nizami Ganjavi was brought up in the historical and literary environment. The author rightly points out that the Atabei who ruled in Azerbaijan in the 12th century – Jahan Pakhlavan, Gizil Arslan, Nasruddin Abubakr and the

social environment created by them created favorable conditions for the revival of Azerbaijan, and all this is reflected in the works of Nizami" [8]. Another claim of R. Ismayilov is interesting. According to him, based on an introduction written by Ya. A. Bertels to Namami's Hamsa in 1946, L. Aragon writes in his book Oriental Literature that Nizami was in close contact with the Akhi Brotherhood society, which operated in his time in Ganja. Thanks to this work, L. Arago meets French contemporaries Nizami, Goffy Dipras, Alexander de Berne, Lambert Le Thor, Bernouat de Narman, Marie de France and Jean Bodel Aras. A. Sarkroglu writes that in this work, Louis Aragon talks about his spiritual closeness with the Nizami. To emphasize the closeness of this idea, he notes that Nizami was a member of the Axi organization, and his French contemporaries were members of the Wearing Wooden Shoes organization, similar to the Axi organization [4].

Studies by Azerbaijani researchers have also revealed features that distinguish Louis Aragon from other French scholars, writers and poets. This is the dedication of Louis Aragon to the poems of poets who ended their lives in tragedy. In 1960, the poet published his work "Poets" in Paris. This large-scale work of Aragon is dedicated to the life of poets who tragically died from ancient Rome to the present. Along with Aragon, Promoteus, A. S. Pushkin, M. Yu. Lermontov and Musa Jalil, he also composed the death scenes of the great Azerbaijani poet and philosopher Imadeddin Nasimi. In this work, the poet mourned the fate of the great artists of mankind, and their untimely death plunged the poet into deep sadness.

Studies show that both the stories One Thousand and One Nights and the stories One Thousand and One Days had a very strong influence on French literature, and French writers created a number of works under this influence [6].

The influence of the story "Good and Evil" on Nizami's poem "Seven Beauties", translated from the tales of Petit de la Croix "A Thousand and One Days", is also noteworthy for Voltaire's story "Envy" in the story "Zadik or Fairy Tale". From the monograph by

Asgar Zeynalov "In the work of East Voltaire" it is clear that Arimaz is looking for an opportunity to destroy Zadik, just as good is an opportunity to destroy evil. Finally comes the moment they were waiting for. One contains water and the other a sheet of paper. Forgiveness belongs to great people. Good Shari and Zadik forgive Arimazi, the "evil creatures" who brought them one step closer to death [5].

Researcher Aziz Gozalov translated part of Koroghlu, translated from French into Azerbaijani by Georges Sand.

The epic "Koroglu", translated into French by Georges Sand as a result of the work of Mahmar Abdullaev and Aigun Vakilova, was translated from French into Azerbaijani and published in 2006.

It should be noted that the study of the Keroglu epos in French literature did not end with Georges Sand. According to researcher R. Ismayilova, since then the French press continues to express scientific views on the epic "Koroglu".

Findings

The study of oriental motifs in French literature began to develop as a new scientific direction in Azerbaijan, especially during the years of independence, when scientific research was free from the influence of Soviet ideology. This article examines the study of the literary heritage of the Avesta, one of the literary and philosophical examples of Azerbaijan, the great Azerbaijani poet and philosopher Nizami Ganjavi, the epic "Koroglu" in French literature. The research of Askar Aliyev in this area was analyzed. The article expresses the attitude of French writers and orientalists to the description of the East, its great literary and historical figures, works and translations reflecting their interest in folklore, and also summarizes the views of Azerbaijani scholars who conducted valuable research in this area. When developing the article, original copies of the works of French writers, the work of Azerbaijani researchers, scientific articles published in magazines and newspapers were used.

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APPROACHES TO UZBEK SLANG AND ITS TYPE: YOUTH AND GENERAL SLANG

Abstract. The present article is concerned with the developing of slangs and different approaches to types of slang in Uzbek. Furthermore, it deals with the development of active term "slang" in sociolect by young generation. The role and function of Youth slang are given in social layer within comparing world linguistic views on the types of slang. As Youth slang is commonly used and created by young people in Uzbek, it is considered to be a dominant factor inside of Slang itself. Some interesting examples of slang are highlighted from communication among Uzbek people.

Keywords: sociolect, non-standard system, jargon, argot, cant, social layer, emotionally- expressive, age- restricted, phonetic mimicry, socio-psycholinguistic.

The literature on *slang* has been extensively developed in English and Russian linguistics including dictionaries, scholar works and articles. In XXI century a concern in slangs is being attracted by Uzbek scholars as well. In Uzbek linguistics, active terms of sociolect "jargon" and "argot" are a part of the lexical structure of the modern Uzbek literary language, with the exception of "slang" term. All of the following non-standard systems of language have not been studied by Uzbek linguists yet, whereas the usage of slang among youth is growing rapidly day by day. It is known that these trios can be found as separate word units in English dictionaries. Basically, slang has come from English language into linguistics, therefore its definition can be found a lot in English and American dictionaries. Regardless of the fact that, some dictionaries refer to "jargon" and "argot" as synonyms for "slang" [9], on the other hand it is defined by its individual order of interpretation, for instance, in the Macmillan English Dictionary, slang is defined as follows [5, 1401]:

Words or expressions that are very informal and are not considered suitable for more formal situations. Some slang is used only by a particular group of people.

While it is true to say that the transition and adaptation of one stylistic layer to another is so unstable and disobedient, that it so complex and difficult to comprehend that it is impossible to draw a line between them and put constraint in non-literary linguistics. "Slang", "jargon" and "argot" are often confused because of their functional closeness in oral communication. Therefore, distinguishing them by language poses is a problem not only for users but also for professional lexicographers [4, 20]. Mostly these three terms (slang jargon, argot) are frequently discussed together in general linguistics, and their other siblings, "cant" is considered coupled with them. Although "cant" has lost its essence in modern linguistics, it is explained as the emergence and origination of slang by the scholars' point of view. In most sources, slang is referred to as street language and has been given several definitions by many linguists. The comments reflect both positive and negative points. Almost every prominent language expert has given his or her own persuasive definition for slang, and some well-known slang scholars have advocated the essence and methods of understanding it.

The eminent scholar of slang E. Partridge suggests the following logical understanding of the phenom-

enon: "Slang is much rather than spoken a literary language. It originates, nearly always, in speech. To coin a term on a written page is almost inevitably to brand it as a neologism which will either be accepted or become a nonce- word (or phrase), but, except in the rarest instances that term will not be slang" [10, 3–6].

The author of many works on this field, I. R. Galperin, denies that slang is stable as separate linguistic phenomenon. He claimed that if the term "slang" serves as an autonomous category in linguistics, it is indispensible to look carefully at the words in it and distinguish them from jargon, dialect, professionalism and commonly used words [1, 107–114]. But the linguist V. A. Khomyakov strongly disagrees: "This view seems a bit nihilistic, as it sums up the tremendous work of many generations of scholars who have studied slang and leaves no doubt as to the existence of slang in the early stages of English language development. Even the slang proved viable itself. Even in other languages, it has been used to refer to a certain layer of vocabulary and phraseology, which has retained all its synonyms" [2, 34]. I. R. Galperin's argument was not sufficiently developed and could not provide a basis for it in his later works. To our way of thinking, it is requisite to capture attention not only to which arguments about the term are precise, but also to its use in oral speech and to the needs of the society in relation to it. Thus, the consideration of the issue must be taken so as to require a serious approach.

Well-known Soviet researcher V. G. Vilyuman, who wrote several articles on the properties of slang, applied the division of slang into two groups: *General slangs* are words and phrases that are common in colloquial speech, generally understood and widely spoken, but beyond the boundaries of English literary dictionaries, vividly expressive, emotionally-evaluative coloring, expressing novelty and originality, as well as stylistic synonyms of literary language words in these features. *Special slangs*, i.e. words and phrases included in special or professional vocabulary: sailors, military, athletes, actors, lawyers, students, etc., local dialect, words and phrases used in narrow groups, as well as argot, social jargon [13, 137].

Linguist V. A. Khomyakov, who demanded that these views be further explored on the slang, clarified the confusion on the slang with his views, shedding light on V. G. Vilyuman's classification of the slang. We can say that the description given to the General slang by the linguist is slightly different from views of V. G. Vilyuman. As he considers: The *General slang* is relatively stable for a certain period, a widespread and generally understood social speech micro system in colloquial terms, very heterogeneous in its genetic composition and degree of approximation to familiar speaking, with a pronounced emotionally expressive a connotation of vocabulary, often representing a mockery of social, ethical, aesthetic, linguistic and other conventions and authorities [2, 39].

Approaches to General slang:

V.G. Vilyuman	V.A. Khomyakov
beyond the boundaries of English literary dictionaries	relatively stable for a certain period
stylistic synonyms of literary language words	emotionally expressive
expressing novelty and originality	representing a mockery of social, ethical, aesthetic, linguistic

Researcher recognizes general and special slang as integral part of the concept of "slang" with notifying them a two-sided individual interpretation. The function that connects each other is that with the help of one the vocabulary of the other expands. It can be understood that the general slang component is enriched at the expense of the special slang. It should be noted that such a statement by the linguist V. A. Khomyakov, the mutual function of the two slangs is clarified very perspicuously. However, in our opinion, it is unsuitable to give jargon, argot, and dialectics into the Special Slang. This classification provides a meaningful

and detailed account of the expert's initial views on the role of slang in the speech layer. Nonetheless, we think that the phenomenon is divided into two types, and the aggregation of all words and phrases of different nature in oral speech within one term is somewhat indifferent by linguists. As proof of our point, we can cite below a number of linguists who have elaborated on their views on the subject. This generally accepted differentiation is criticized by M. M. Maykovsky. The author takes such an approach that "slang as jargon never belonged to narrow social groups and it never performed the secret function of particular professional community. Thus, the main feature of slang is that it is common to all social groups of native speakers, so it is inappropriate to distinguish between general and special slang. In the second case, it is often about another type of slang" [8, 23]. The argument of the Indo-European linguist is, in our opinion, a very plausible one. Unfortunately, the linguist's point of view is not sufficiently substantiated.

Elise Matiello, a young scientist at the University of Pisa, conducted her first study on English slang. We can evaluate this issue as the most accurate and comprehensive classification: " Slang differs from jargon in its lack of prestige and pretentiousness. In fact, slang terminology is much more familiar and spontaneous than the technical jargon of science, medicine, academics, law bureaucracy, business, etc. Slang may be used within a particular group like musicians, doctors, soldiers or seamen, but it does not exactly deal with status or reputation" [6, 36]. From this it can be understood that slang is a unit that easier to understand than jargon. Jargon is a word within a profession that only those who work on that field can understand its essence. Linguist V. N. Yarseva: Argot is a special criminal language, unlike slang and jargon, which consists of arbitrarily selected mutated elements of one or more natural languages of a very narrow and limited professional or social group, keeping the subject secret from communication [12, 43].

According to our way of thinking, linguists need to take a comprehensive approach to this debatable statement. Fundamentally, the slang carriers are young people, making it an element of pop culture that is considered necessary for prestige and self-expression [7, 35] It is estimated that the creators of slang are youth, as well as those who promote slang to the public. At this point, we decided that the slang content should be divided into two groups in Uzbek language:1. Youth slang (YS) 2. General slang (GS)
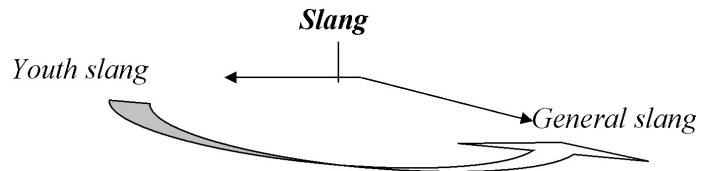

Image highlights the fact that GS are mostly build up by young members of society and are widely used as they are passed onto other users of social layer. Thus, YS is the dominant unit in the slang structure enriching GS vocabulary. From a sociolinguistic point of view, there is an unnoticeable difference between YS and GS units. The native speakers of English interpret the second concept as words and phrases that are widely understood and used in colloquial speech, figuratively, emotionally-evaluative, expressing their originality, constantly served as synonyms for literary words. We also understand daily used vocabulary and phraseology, which have descriptive-expressive and basic emotional functions, when we say the general slang in the wide range mentioned above. In order to avoid subjective interpretations, the GS as a lexical-phraseological layer of spoken language, according to V. A. Khomyakov, has a number of features [2, 39]. The use of slang, which is a daily lexicon, is observed mainly in the homeland of slang England and America. In the Uzbek language, due to the development of society and socio-economic changes in the XXI century influenced for demanding of GS words and phrases extensively, which are now emotionally evaluative by population of the country.

The main differences between youth slang and youth jargon are that youth slang has a vast range of social connotations in line with GS characteristics, is brightly expressed emotionally-expressive, humor-

ous, and is used by people of different ages in social strata. The characteristics of youth jargon, on the other hand, are comprehensible in a limited area belonging to a narrower group of individuals, and therefore, in addition to fatal intentions in relation to its members can express and hostility towards "strangers" [11, 59]. Youth slang, as mentioned above, is more pliant to dissimilar age social group with the reason why so intensive. Unlike jargon, slang has no professional limitations (young people are not just a group of people united by occupation, this is a large social group), its use is more likely indicates a certain cultural position of the speaker, i.e. slang-this is a "phenomenon of a peculiar attitude performing world outlook and ideological functions [11, 60].

In the sociolinguistic approach to the study of YS, slang users are no doubt asked the question of setting an age limit. To this end, we also found it necessary to set the age limits for the YS below, based on the materials of the researchers of "Modern Russian Youth Slang" A. Yu. Ramanov. It is noteworthy that issue was developed by Russian linguists. To study the age-related differences in human language behaviors, sociolinguists define a group of language users according to their biological and chronological age in terms of speech.(e.g., 15–20, 20–25, 25–30 years old, etc.) "Completion of formal education, stable employment, family and children, naturally, this happens at different ages for different people, but on average, changes in family and work status in Russia occur at the age of 23–30. From around this age, obviously, language behavior should begin to alter", admits the linguist. Moreover, in his sociolinguistic survey, it was discovered that the age group of 13 to 14 year olds is mainly the creators of slang. M. M. Kopylenko mentioned that youth jargon is used in communication between people aged 14–25 [3, 48]. Based on the over approaches and observations, we can say that YS is multi-faced word and phrase that is used in free communication between people aged 13–30. It has been ascertained that individuals over the age of 30 tend to display more aspirations for literary language norms in

their speech, but they also use slang in order to bring a sense of humor to their communication (as well as a number of slang-specific features). In this case, they use slang, i.e. YS, invented and broadly used by youngsters. In Uzbek language there are several YS which are borrowed from English language, as we can call them borrowing slang words:

– пати- party (зиёфат), фаворит- favourite (севимли), гугле-google (қидирув хизмати), респект-respect (ҳурмат), чики-чики-Cheeky-cheeky (зўр), фолловерларимиз-followers-(кузатувчилар), юзерлар-users-(фойдаланувчилар).

In the method of phonetic mimicry, the pronunciation of assimilated words through semantically similar aspects with commonly used words. Such words are mainly active in Russian and are formed by comparing words derived from English. Needless to say, in Uzbek, a number of such slangs can be found, adapted to the common word in the acquired language: Шароит – Share it

An English word expression *Share it [ʃeə ɪt]* has a bit different pronunciation for Uzbek users, therefore it was compared to another literary word in the language keeping meaning in English. If we look at the lexeme of *"Шароит"* in the "Explanatory dictionary of the Uzbek language": Шароит [шартлар, тартиб қоидалар] 1. Объектив ҳолдаги муайян вазият. 2. Бироз нарсанинг воқеаланишига таъсир этувчи ҳолат, вазият, имконият.

Шароит [conditions, rules] 1.A specific situation in the objective state. 2. A situation, circumstance, opportunity that affects the occurrence of something.

Uzbek slang *"шароит"* is a program installed on the phone, which usually serves to transfer several functions such as photos, videos, software, and so on. It is used in oral speech as follows: (In conversation) 1) Шароитингни ёқдингми? *Расмларни юборя*пман. 2) Шароитинг борми? Зўр нарса ташлайман.

As we can see, the user can fit it borrowings to a commonly used word if it is arduous to pronounce.

Furthermore, as a result of our studies within the GS, the YS should also be worthy of its own character-

istics, in which case we give it the following approach in Uzbek language: Slang is the language of (1) youth. It is kind of live communication to bring a spirit of novelty and modernity, to show fun and joy in order to move away from the old in exchange of information. It does not reflect any (2) bias and rude features. It is therefore genetically and functionally different from argot and vulgarism. (3) YS do not have professional limitations (this is large social group and not professional terms). This aspect is different from youth jargon. Due to time goes by, the vocabulary of YS will also be updated. Hence, its most significant feature (4) is novelty. Consequently, there exists a synonymy in slang. The old ones are replaced by new ones. Apart from this, it is characterized by semantic (5) humor. The context is used in the form of humor in order to avoid sadness and uninteresting atmosphere, and appear emotional-expressive conversation. It is a (6) word game of the younger generation a means to distinguish them from oldster. Furthermore, it has brightly expressed (7) emotional-evaluative character. It differs from the GS within (8) age-restriction, besides the vocabulary of GS enriches due to the YS, ergo it is a dominant unit in the slang structure. (9) There are 5 main functions of its creation. Consciously, the (10) socio-psycholinguistic approach is also stable in it, as it requires ingenuity and adroitness. Young generation have a vivid fantasy to build up new words and expressions outside of standard vocabulary. It is evident that there is recycling system in language as appearing new words and losing old ones. The obvious conclusion to be drawn is that it is worthy to scrutinize thoroughly of slangs in other sphere in modern Uzbek language as it is demand of usage them in social layer.

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Section 10. Economics

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WAYS TO İMPROVE SOCİAL ASSİSTANCE AND SERVİCES İN AZERBAİJAN

Abstract. Improving the standard of living and improving the structure of consumption are also the main goals of the socio-economic policy pursued by Azerbaijan. After Azerbaijan gained independence, large-scale programs aimed at improving living standards and improving consumption were implemented in the country, a strong economic and regulatory framework was established, and a governance system was created to ensure the creation of a socially oriented market economy in the Republic of Azerbaijan.

Keywords: standard of living, social assistance, allowance, living minimum, consumer basket, social service.

İn 2018, 118,000 permanent jobs were created in the country with the increase of industrial production, non-oil sector, and monetary income of the population, investing 17.2 billion manat into the country's economy.

According to calculations of the Davos Economic Forum, our country is ranked 35th in global competitiveness, and third in developing countries, according to the inclusive development index, as well as the top 10 reformers in the Doing Business 2019 report, its 25th place among 190 countries is a clear indication of the way our country has progressed.

Various factors affect the improvement of the standard of living of the population, one of which is the provision of state benefits to the population.[3]. The impact of the state on the quality of life and social development is measured by financial regulation, market relations of the state, or by the level of direct access and guarantee. The organization of social security within certain limits finds its normative basis in the functions and mechanisms of the state's distribution. Social security, as regulated by legislation, is based on conceptual orientations as a progressive policy. As the economy develops, wages, pension reform, and poverty reduction measures are also regulated.

In addition, targeted state social assistance to low-income families plays an important role in their budget.

The implementation of this system has had a positive impact on the living standards of the population of the country, mitigating the differences between the youth population groups. In 2018, the number of family members receiving targeted state social assistance was more than 450,000 [2].

The average monthly pension in the country increased by 8.4% compared to the same period of the last year and amounted to 219.2 manat and equals 39.6% of the average monthly salary (38.7% in the first half of 2017). As of July 1, 2018, 409.300 people were granted social allowances. The number of beneficiaries for age benefits was 42.7 thousand, for disabled people – 164.1 thousand, for loss of a family head – 45.5 thousand, for children with limited health benefits – 74.0 thousand.

The number of pensioners working in the country was 13.4% of the total pensioners. This ratio varies considerably across the region. For example, pensioners working in Baku accounted for 20% of total pensioners, 13.2% in Absheron economic district, and 5.5% in Lankaran economic district. In our opinion, this difference can be explained by the fact that employment in the regions is more serious than in Baku.

Regions also differ by the average monthly amount of pensions. For example, this amount was 238.6 manat in Baku, 152.2 manat in Guba-Khachmaz zone and 156.2 manat in Ganja-Gazakh zone. In other economic zones, the average pension is about 150–160 manat. The region's average size of pensions is directly affected by the economy's wage levels in the areas where pensioners work. For example, in highly industrialized cities, pensions are higher than in rural areas. This amount was 168 manat in Sumgayit, 163 manat in Shamkir, 170 manats in Siyazan, 171.7 manat in Shirvan, which is higher than average in many regions.

The concepts of the minimum consumer budget and living wage are used to assess the standard of living of the population, the development and implementation of regional programs, the determination of wages, social benefits [5].

An indicator of the impact of rising prices on the incomes of the population is the Consumer Price Index – this price index is included in the consumer basket of the average urban population.

The cost of the consumer basket is determined by the average scientific prices for food products, which are included in the consumer basket of different age groups by the scientifically justified physiological consumption norms of food products set by the competent health authorities and sold in a particular area (country, city, region, etc.). The consumer basket is a set of goods and services that should provide a comfortable and comprehensive life for the whole year. The cost of living depends on the structure of

the consumer basket, which is subject to changes and additions every year (according to the decision of the Cabinet of Ministers).

The minimum consumer basket in our country is primarily food, which accounts for about 50% (in some Western European countries this figure does not exceed 20%). It should be noted that this indicator is similar in our country and in many other countries of the Soviet Union. The second group includes nonfoods – clothes, footwear, medicines, etc. includes. Consumer basket services include utilities, transportation costs, cultural events and more.

As a rule, the living wage in Azerbaijan is submitted to the National Council in conjunction with the draft State Budget of the year and is approved after discussion. Let us also note that the living wage is set separately for the working population, pensioners, and children.

In particular, we would like to point out changes in the level of poverty in the country. In 2010–2018, the number of poor people in our country has been reduced to a minimum, the poverty level has been reduced by more than 9 times.

The implementation of adopted state programs on socio-economic development of the regions over the past decade is of great importance in the development of the regions of the country to a new quality stage. As a continuation of the policy of comprehensive development of the regions, starting from 2004, the State Program on Socio-Economic Development of the Regions of the Republic of Azerbaijan for 2014–2018 was developed by the Decree of the President of the Republic of Azerbaijan dated February 27, 2014 No 118. Implementation of the "State Program of socio-economic development of the regions of the Republic of Azerbaijan for 2014–2018" is important for the development of the country's economy, ensuring macroeconomic stability, expansion of entrepreneurship in the regions, creation of new enterprises and jobs, implementation of large-scale infrastructure projects played an exceptional role in improving the quality of public services, ulti-mately improving the welfare of the population and reducing poverty [1].

The results of regular household surveys to assess the implementation mechanism of the Law of the Republic of Azerbaijan on Targeted State Social Assistance, as well as the opinion of international experts, indicate that targeted assistance in the country is being followed. However, it should be noted that the improvement of the targeted social assistance system is becoming more and more relevant year by year.

One of the most important factors affecting the standard of living of the population is its education. The progressive scientists and educators of our people have always called on people to acquire knowledge and literacy and worked hard for the progress of the nation. For comparison, if the literacy rate was 1% in Azerbaijan at the beginning of the twentieth century, statistics now suggest that this figure is over 99%. In general, Azerbaijan is one of the leading countries in the world in terms of its literacy rate.

One of the prerequisites for improving the living standards of the population, especially families with young children, is the provision of a network of pre-school education institutions in the country [8]. Important measures were taken to comprehensively develop, raise the level of education, intellectual development, numerous new school buildings were built, children and boarding schools were renovated and equipped with modern facilities.

In 2018, there are 1,785 pre-school educational institutions in the country, of which over 96% are under the government's control. The number of children studying here was 120 thousand 383. However, the number of children involved in pre-school education (children aged 1–5) is 16.6% of the total number of children, which is lower than in many countries. In rural areas this figure is two times lower than the national average. In most cases, the number of places available in kindergartens is much lower than the number of preschool children living in the relevant area, district, and city. In this regard, expanding the construction of pre-school education at the expense

of the state and involving children is one of the most important socio-economic issues that can lead to a positive change in the consumption structure of low-income families, as well as allowing working mothers to stay away from their jobs [6].

At present, there are 3 boarding schools for children who have lost their parents or are deprived of parental care, and according to 2018, 464 children are studying and living there.

A number of countries have adopted a law on social services that defines the legal, economic and organizational basis of public policy in the area of social services for people living in difficult life situations. The Law of the Republic of Azerbaijan on Social Service adopted in 2011 states that the purpose of social services is to prevent situations that aggravate the standard of living of citizens, complicate their socio-psychological status and lead to their exclusion from society [4].

The provision of social services is based on a social worker's assessment and determination of the need for social services for a person (family) living in difficult circumstances. Criteria for assessing and determining the demand for social services are: social remembrance; social deprivation (deprivation); unsuccessful social environment [7].

Social services are funded by the state budget in the manner prescribed by law, the proceeds from the provision of paid social services, donations of legal entities and individuals, grants, as well as other sources provided by law. Taking into account the fact that the budgetary funds allocated to these areas are increasing year by year, the social services sector is inevitable and it will play a role in the growth of employment, it would be advisable to focus on accounting and improving statistics.

In providing social assistance to low-income families, families with disabilities, the elderly, children and other vulnerable groups (including persons with disabilities in the family, elderly people, other disabled people) it is necessary to improve the amount of allowance for land, which cannot be used or regularly used for objective reasons, especially when compiling property lists.

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DETERMINATION OF BIOLOGICALLY ACTIVE SUBSTANCES – FLAVONOIDS IN FRUIT TREES WITH HEALING PROPERTIES

Abstract. The article cites the results on the amount of flavonoid content in the birch trees. Flavonoids are synthesized only in plants and have important biological significance in the human body. The results show that in spring the content of flavonoids in grape leaves was high and amounted to 4.721 ± 0.521 mg/g, in the summer they were 3.825 ± 0.255 mg/g, and in the fall, flavonoids decreased to 1.460 ± 0.2253 mg/g. In spring, flavonoids in the stems of grapes were 4.386 ± 0.046 mg/g, in cocoons 0.348 ± 0.023 mg/g.

Keywords: antioxidant, flavonoids, black here, peach, cherry, Greek nut, grape, extract.

In our department, with the aim of correcting rats poisoned by pesticides [1], we conducted research in search of drugs from cheap, convenient and local plants [2] with antioxidant properties [3; 4; 5]. Flavonoids are synthesized only in plants and have important biological significance in the human body [5]. The healing properties of some plants depend on flavonoids, which in turn depend on the period of plant development [7]. With a lack of flavonoids in the body, a number of disorders occur. Most flavonoids improve the elasticity of the blood vessel wall and regulate their permeability.

Flavonoids of some plants also have choleretic and diuretic properties.

The main goal of our work is to determine the content of flavonoids in the leaves of fruit trees. And for this, we determined the content of flavonoids in the leaves of the black mulberry, peach and walnut, which have medicinal properties, at different times of the year.

To determine the amount of flavonioids in plants, the spectrophotometric method is used [8].

To detect flavonoids by spectrometric method, we used flavonoids from biological material treated with 96% X-100 triton solution. The reaction is based on the formation of a color complex under the influence of a boric solution of citric acid on a flavonoid released from plant tissues [6].

The content of flavonoids formed at different times of the year in the leaves of fruiting plants with healing properties has been little studied. And so we studied flavonoids – biologically active substances contained in the leaves of plants with antioxidant properties.

Our results show that the number of flavonoids in the composition of the leaves of fruit trees at different times of the year is different.

Walnut (Juglans Regia L) is grown in large quantities. The leaves and peel of walnuts and peanuts contain vitamins C, P, B_1, carotene, essential oils. The pulp contains fats, carotene, vitamins C, E, P and group B, iron and cobalt salts.

The content of flavonoids formed at different times of the year in the leaves of fruiting plants with healing properties has been little studied. And so we studied the amount of flavonoids in the leaves of some fruiting plants at different times of the year. The greatest number of flavonoids in walnut leaves was 6.384 ± 0.857 mg/g in the spring, and in summer and autumn there was a decrease in its content, in the summer within 4.45 ± 0.446 mg/g, and in the fall 4.83 ± 0.060 mg/g. In the spring, it was found that the amount of flavonoids in the walnut fruit was 4.227 ± 0.908 mg/g, and in the stems it was 0.778 ± 1159 mg/g.

Table 1.– The number of flavonoids in the leaves of fruit trees (mg / g)

№	Name of plants	Spring	Summer	autumn
1.	Walnut	6.384 ± 0.857	4.45 ± 0.446	4.83 ± 0.060
2.	Black mulberry	0.950 ± 0.050	3.805 ± 0.766	2.875 ± 0.470
3.	Peach	2.946 ± 1.091	5.140 ± 0.566	4.120 ± 0.460
4.	Grape	4.721 ± 0.521	3.825 ± 0.255	1.460 ± 0.253
5.	Figs	3.415 ± 0.443	1.885 ± 0.033	3.990 ± 0.260

Black mulberry (Morus nigra L) is sown in Central Asia, the Caucasus and other places. The cores of black tuta, wood and plaster contain tannin and dyes (morphine pigments). Leaves contain vitamin C. Fruits contain carbohydrates, vitamin C, sourdough, iron, glycosides, pectin and other substances.

Black mulberry leaves are used to treat diseases of the gastrointestinal tract, with sore throat, throat tumors, diabetes mellitus and skin diseases. A high content of flavonoids in the leaves of the Black Mulberry was found in the summer and amounted to 3.805±0.766 mg/g, in the spring 0.950±0.050 mg/g and in the autumn 2.875 ± 0.470 mg/g.

Peach (Persica vulgaris M) is widespread in China and the Central Asian republics. The seed contains oils, essential oils, amygamine glycosides, emulsion enzymes and other substances. The soft part of the fruit contains carotenoids, carbohydrates, vitamins C, B_2, organic acids, essential oils, pectin, potassium and magnesium salts, as well as trace elements (3).

Peach leaf juice and decoction are used to treat rheumatism, headaches, and gastrointestinal upsets.

Our results show that the content of flavonoids in peach was higher in the summer and was 5.140 ± 0.566 mg/g. In spring, the amount of fla-

vonoids was 2.946 ± 1.091 mg/g, and in autumn, 4.120 ± 0.460 mg/g.

The grape family (Vitaceae) is a perennial plant. Grapes contain carbohydrates, organic acids, vitamins C and B, flavonoids, dyes, tannin seeds, quercetin, inositol, choline, organic acids, carotene, vitamins C, B and K in the leaves.

Our results show that in spring the content of flavonoids in grape leaves was high and amounted to 4.721 ± 0.521 mg / g, in the summer they were 3.825 ± ± 0.255 mg/g, and in the fall, flavonoids decreased to 1.460 ± 0.2253 mg/g. In spring, flavonoids in the stems of grapes were 4.386 ± 0.046 mg/g, in cocoons 0.348 ± 0.023 mg/g.

Figs (simple figs – Ficus Carical) – blooms in April-May, and its fruits ripen in June-August. It grows in large quantities in Central Asia, Kazakhstan, Krasnodar, the Caucasus and the Crimea. The fruit contains B, C vitamins, carotenoids, organic acids, mineral salts, proteins and carbohydrates. In scientific medicine, the pharmacokinetics of furocoumarins has been developed.

The largest amount of flavavinoids in fig leaves was found in autumn, and the amount was 3.990 ± ±0.260mg/g, and in spring, fig leaves contained 3.415 ± ± 0.443 mg/g, and in summer 1.885 ± 0.033 mg/g.

The results show that the amount of flavonoids in the leaves of fruiting plants with medicinal properties is different in different seasons and depends on the growing season, and its high concentration in spring was found in walnut leaves.

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