FORMATION OF COGNITIVE AND COMMUNICATION SCENARIOS OF TRANSDISCIPLINARY INTERACTION WITH CONSOLIDATED NETWORK NARRATIVE INFORMATION RESOURCES THROUGH AN ONTOLOGICAL INTERFACE

Andrii Honchar

Abstract*: The article is devoted to the means of providing users with access to a virtual presentation of digital historical, cultural and scientific documentary heritage. A model of an advanced ontological interface is presented, which is considered as a linear operator to expand the list of properties of the set of elements of the ontology of the virtual museum and the formation of new classes of objects displayed in the corresponding states of the 3D panorama. The interaction of the user with the consolidated information resources, which are accessed through an improved ontological interface, is carried out by implementing a cognitive-communicative scenario, which is defined as an ontological excursion route. An infologic model of the ontological excursion route is presented. The algorithm of realization of the method of transdisciplinary consolidation of network information resources and knowledge systems of meaningful reflection of historical and cultural heritage is given. The ontological IT platform of transdisciplinary consolidation of 3D-panoramas with network information resources of historical and cultural heritage content representation is presented. In its environment, the cognitive-communicative scenario of interaction is realized.*

Keywords*: ontology, virtual museum, 3D panorama, taxonomy, narrative.*

ACM Classification Keywords*: I.2 ARTIFICIAL INTELLIGENCE - I.2.4 Knowledge Representation Formalisms and Methods*

Introduction

Global informatisation of education, science and culture is characterized by the rapid activities to transform the accumulated knowledge into digital form: creating electronic archives, libraries, collections, repositories, access to which on the Internet is open to anyone. This trend is characteristic not only of traditional repositories of documentary information, such as libraries and archives but also of museums. In this case, the museum funds cannot be directly transformed into digital form but the descriptions of these funds can be digitized and include complete information about each storage unit, as well as the related information - images, presentations, audio and video data.

Over the last twenty or thirty years, in countries with developed economies, objects of historical and cultural heritage have been intensively digitized and presented in the online environment: archival documents, book collections, museum exhibits, etc. The online access to digitized historical, cultural and scientific documentary heritage started with the creation of the electronic catalogs of the largest collections of archives, libraries, museums, which contained only descriptive information. This information played only the presentation role. The number and variety of projects of national, regional and local level that in theory should ensure the integration of information resources of many heritage objects, led to inconsistency and sometimes contradictions in the way of information presentation, use of description standards for the metadata of the electronic collections, in the formation of the user interface etc.

The process of active use of information resources in the network is characterized by the formation of network-centric transdisciplinary environments in which very large amounts of information circulate, which determines the problem of big data (Big Data) [Dovhyi, 2020; Mayer-Schönberger, 2013; Hariri, 2019]. Transdisciplinarity provides for the interpretation of the whole set of interdisciplinary contextual relations between information resources as knowledge systems, which creates the conditions for the development of cognitive-communicative scenarios of interaction between different topics and formats of thematic network fragments. And the Big Data problem causes

another problem - the consolidation of these cognitive-communicative scenarios.

Consolidated interaction with network information has been actively studied for the last 30 years [Serebryakov, 2014; Kunanets, 2010; Takashima, 2017; Battaglia, 2011; UNESCO, 1978]. Digital formats of information resources, which form the basis of interaction in network environments, determine the problem of their integrated and more consolidated use, and research aimed at solving it is conducted in two directions. Researchers [Serebryakov, 2014; UNESCO, 1978; Kalytych, 2008] define consolidation as a combination of the same type of information based on characteristic attributes. This eliminates the difference between consolidation and integration. The selection of characteristic groups of attributes of information and data is inherent in the integration of databases that characterize the same type of information resources. In fact, this interpretation of consolidation reduces it to the simple use of certain data in the process of solving practical unified problems.

In contrast to this approach, other researchers [Dovhyi, 2020; Kunanets, 2010; Takashima, 2017; Battaglia, 2011] consider consolidation as a certain combination of semantic processes that are realized in the network space. The use of ontological engineering mechanisms is proposed as a construct of consolidation [Dovhyi, 2020; Gomez-Perez, 2004; Palagin, 2016]. The use of the methodology of ontological systems provides a representation of the semantic properties of information resources and realizes the interaction with them and between them.

Analysis of available global and domestic information Internet resources shows inconsistencies in the choice of accounting standards and the creation of metadata for information resources, as well as software that would allow data entry in an open format for further use in full-fledged databases. Domestic archives, libraries and museums, digitizing their funds and providing access to them, still do not make full use of the opportunities and achievements of modern information technology. They still remain each in its own field, while for the modern user the origin of the information does not matter, he wants to get it

here, immediately and efficiently, rather than looking for the necessary information on the scattered sites of various institutions. Therefore, the urgent task is not only to develop and implement holistic unified requirements for the description of digitized objects and their quality (regardless of origin), but also the use of open source software to ensure compatibility and interoperability of data. This will allow the development and implementation of interactive consolidated information resources that will ensure the efficient search for electronic objects in open databases, and thus provide quality information services to users.

An important step towards ensuring free access to the digitized historical, cultural and scientific heritage is the creation of publicly available online resources (web-sites, portals, etc.), which requires the development of common standards and methodological solutions for their use.

Providing users with access to a virtual presentation of digital historical, cultural and scientific documentary heritage requires the development of models and methods of networking for any institutions that use different types of specific metadata, such as technical, conceptual, procedural, administrative and others.

The purpose of the article is to acquaint readers with the formation of cognitive and communication scenarios of transdisciplinary interaction with consolidated network narrative information resources through an ontological interface, which is a great way to get acquainted with the historical, cultural and scientific heritage of world civilization.

Improved Ontological Interface Model

The information environment of the heritage object is a complex space of user interaction with consolidated information resources about processes, facts, events and phenomena of history and culture. It is therefore a means of accumulation, systematization and classification, structuring large amounts of spatially and thematically distributed information, its formalized representation, aggregation and integration with other information sources and knowledge systems designed to analyze existing and generate new knowledge.

The information environment of digital image of the historical and cultural heritage preservation object (DIHCPO) is considered as a symbiosis of visual and meaningful presentation of historical and cultural processes, facts, events and phenomena, which is realized based on the cognitive means of storage, processing, visualization, analysis of information to meet the information needs of users. This environment includes object with the metadata elements of preservation of historical and cultural heritage, services of the cognitive processing and presentation of consolidated information resources that define the types of metadata and define their values and users.

The implementation of the cognitive-communicative scenario is carried out by user interaction with consolidated information resources, which are accessed through a fragment of the 3D-panorama and is a sequence of its actualized states in the process of the achieving the goals in the environment DIHCPO. Therefore, it is necessary to develop tools and methods that will ensure this interaction.

According to [Popova, 2013] ontological interface user interaction with aggregated and integrated distributed information resources is defined as a linear operator mapping the aggregated status of solving problems using active ontologies:

$$I = \langle T, O \rangle . \quad (1)$$

The ontological interface I provides selection from the active ontology O, term field X of which used to solve a problem, a separate ontology O^*, which is formed by many tautologies X^i from selected concepts-objects x_m and x_n:

$$\langle T,O\rangle \xrightarrow{I} \langle T,O^*\rangle, \quad (2)$$

$$\exists X^i \subset O^* \subset O, \forall X^i \subset O^*, \exists (x_m^i, x_n^i) \quad (3)$$

where O^* – an ontology formed by a set of tautologies of concepts X^i, selected from the active ontology O;

$r_{mn}^i = x_m^i \times x_n^i$ – relationship between concepts x_m and x_n, forming tautologies, $x_m^i \in X^i, x_n^i \in X^i$ [Popova, 2014].

The ontological interface represents the aggregate states of the problem-solving process, provided that there is a non-empty subset of the properties of the objects of the ontology aggregation set $R^i \subseteq R, R^i \neq \varnothing$, each property $r_n^i, r_n^i \in R^i$, of which belongs to the objects of only one ontology $r_n^i \in O_1 \wedge r_n^i \notin O_2$.

$$\exists R^i \subset O_1 \subset O \vee \exists R^i \subset O_2 \subset O, \quad (4)$$

However, this model cannot be applied to DIHCPO, as elements of different historical and cultural heritage sites may have the same property (for example, created by the same author or in the same technique, or in the same period of time, etc.).

Suppose the existence of ontologies O_{vm1} and O_{vm2}, whose objects have a common set of properties R, but describe different DIHCPO. Applying the method of inductive search to all values $r, r \in R$ set of properties R, we obtain a set of matching Cartesian products $R = \prod_i^n X_i$ for both ontologies, which leads to the formation of many functions $F = X \times R$, set over objects as O_{vm1}, so and O_{vm2}. Thus, the elements of the ontology O_{vm1} and O_{vm2} coincide in certain properties. So, the ontological interface as a linear operator ensures that at least one new property is assigned to ontology objects, ie extends the list of properties by at least one.

According to (1), the ontological interface of the DIHCPO information model represents a set of elements of the heritage object, arranged in a certain way according to their properties. Given the assumption of the existence of a subset of the properties of the elements O_{vm1} and O_{vm2}, we assume that there is a subset of properties that does not belong to any element of the two DIHCPO. Then the ontological interface should form a set of Cartesian products with a new set of objects $I_{vm} \Rightarrow \prod_i^n X'$, resulting in undefined elements of the DOICH ontology O_{vm}, reflected in the states of the 3D panorama, forming a new element with a new property. Thus, the use of an ontological interface I_{vm} leads to an expansion of the list of properties of the set of elements of the ontology O_{vm} and the creation of new classes of objects (expositions, exhibitions, halls, etc.), which are displayed in the appropriate states of the 3D panorama.

In the visual representation of the element of the ontological interface of DIHCPO (in this case a virtual museum) I_{vm}, with which the user interacts in the process of implementing a cognitive-communicative scenario, there is a fragment of 3D-panorama with an integrated "unified window" of access to digital narratives of descriptions of this exhibit – consolidated semantically related contexts of physically and thematically distributed information resources created in different formats, according to different standards and technologies, in a unified system-organized museum space. This allows us to present narrative discourse through a cognitive-communicative act, which

simultaneously implements based on the intertextual connections the consolidated use of selected information resources and their interpretation as reflection and representation.

The cognitive-communicative scenario of interaction with the 3D-panorama of the virtual museum, consolidated with the network information resources of the historical and cultural heritage content representation, is represented by a tuple

$$O_{3D} = \langle O_{vm}, I_{vm} \rangle \quad (5)$$

where O_{vm} – ontological model of a virtual museum, in the environment of which research activities are carried out;

I_{vm} – a procession of states of 3D-panoramas of a virtual museum, which are updated during the implementation of the cognitive-communicative scenario in order to achieve research goals

$$I_{vm} = \langle I^0, I^1, ...I^i, ..., I^n \rangle \quad (6)$$

Thus, the ontological interface model is improved I_{vm} and is a means of forming a cognitive-communicative scenario of user interaction with consolidated DIHCPO, reflecting digital narratives of descriptions of exhibits in a single system-organized museum space.

Formation of a Cognitive-Communicative Scenario in the Form of an Ontological Excursion Route

The process of user interaction with several predefined virtual objects of historical and cultural heritage, realized by forming a cognitive-communicative scenario, will be defined as an ontological excursion route. The infographic model of the ontological excursion route can be formally represented by a tuple:

$$O_{route} = \{X, R, F, D_o, D_{GIS}\}, \quad (7)$$

where X, R, F – finite sets, respectively:

X – set of historical and cultural heritage sites included in the route $X = \{X_M, X_L, X_A, ..., X_{obj}\}$,

where X_M – set of museums, $(x_{M_1}, ..., x_{M_n}) \in X_M \mid X_M \subset X$;

X_L – set of libraries, $(x_{L_1}, ..., x_{L_n}) \in X_L \mid X_L \subset X$;

X_A – set of archives, $(x_{A_1}, ..., x_{A_n}) \in X_A \mid X_A \subset X$;

X_{obj} – set of other sights (monuments, historical complexes, architectural ensembles, etc.), $(x_{obj}, ..., x_{obj}) \in X_{obj} \mid X_{obj} \subset X$;

R – set of relations between the objects of preservation of historical and cultural heritage, which determine the direction and sequence of inclusion in the route $R = \{R_M, R_L, R_A, ..., R_{obj}\}$;

F – set of interpretation functions X and/or R;

D_o – set of ontological descriptions of the steps from which the route is formed;

D_{GIS} – set of descriptions of actions performed in the GIS environment to synchronize the display of the ontological tour route.

The basis of the ontology of the excursion route is a taxonomy represented by a set of bipartite graphs $G=(N,E)$, the vertices of which are the names of objects of preservation of historical and cultural heritage N, $(N_{obj_1},...,N_{obj_n}) \in N_{obj} \mid N_{obj} \subset N$, grouped into classes (according to the type of heritage object - museum, library, archive, etc.), and arcs - the semantic relationship between them E, based on which objects are grouped into classes according to their properties

$$(G_M,G_L,G_A,...,G_{obj}) \in G_{route} \tag{8}$$

Since in real life the tour route is not homogeneous, ie one that includes heritage sites of only one type (for example, only museums, or only monuments), there is a dynamic redistribution of objects during the tour, which can lead to the formation of new classes of taxonomic objects:

$$G_M \cup G_L = G(N,E) \mid N_M \subseteq N, N_L \subseteq N; E_M \subseteq E, E_L \subseteq E \tag{9}$$

$$N_M \cap N_L = \{N \mid N \in N_M, N \in N_L\} \tag{10}$$

The process of forming a tour route in the environment of taxonomy is reduced to solving the travelling salesman problem on the graph, and then displayed in the environment of GIS.

Method of Transdisciplinary Consolidation of Network Information Resources and Knowledge Systems of Meaningful Reflection of Historical and Cultural Heritage

Cognitive-communicative scenario of interaction of users of 3D-panoramas with network information resources of the historical and cultural heritage content representation through the improved ontological interface (Fig. 1) requires the

development of a method of transdisciplinary consolidation, which would implement the process of forming a single system-organized museum space.

The method of transdisciplinary consolidation includes several stages (Fig. 2).

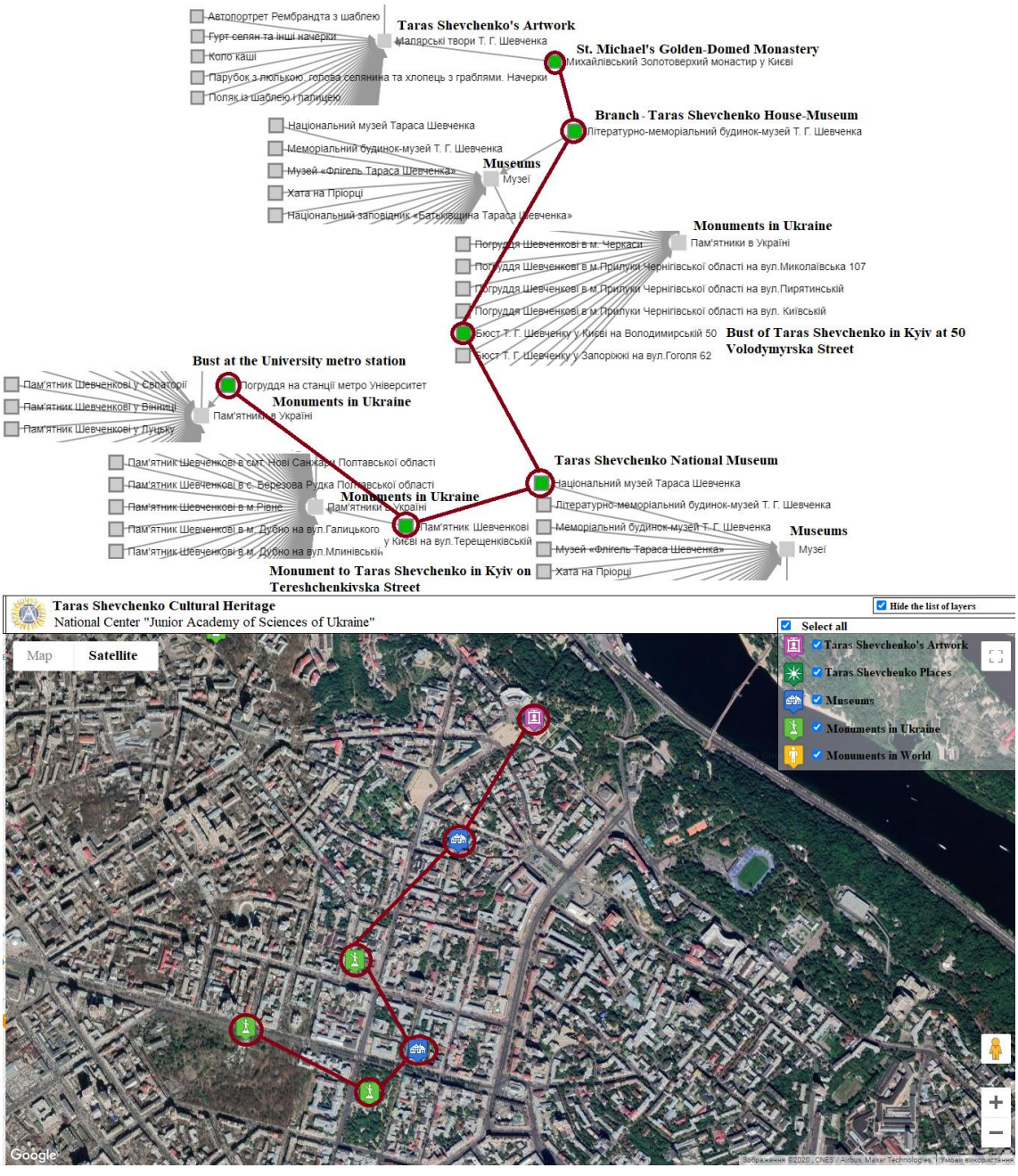

Fig. 1. Implementation of the cognitive-communicative scenario in the form of an ontological excursion route

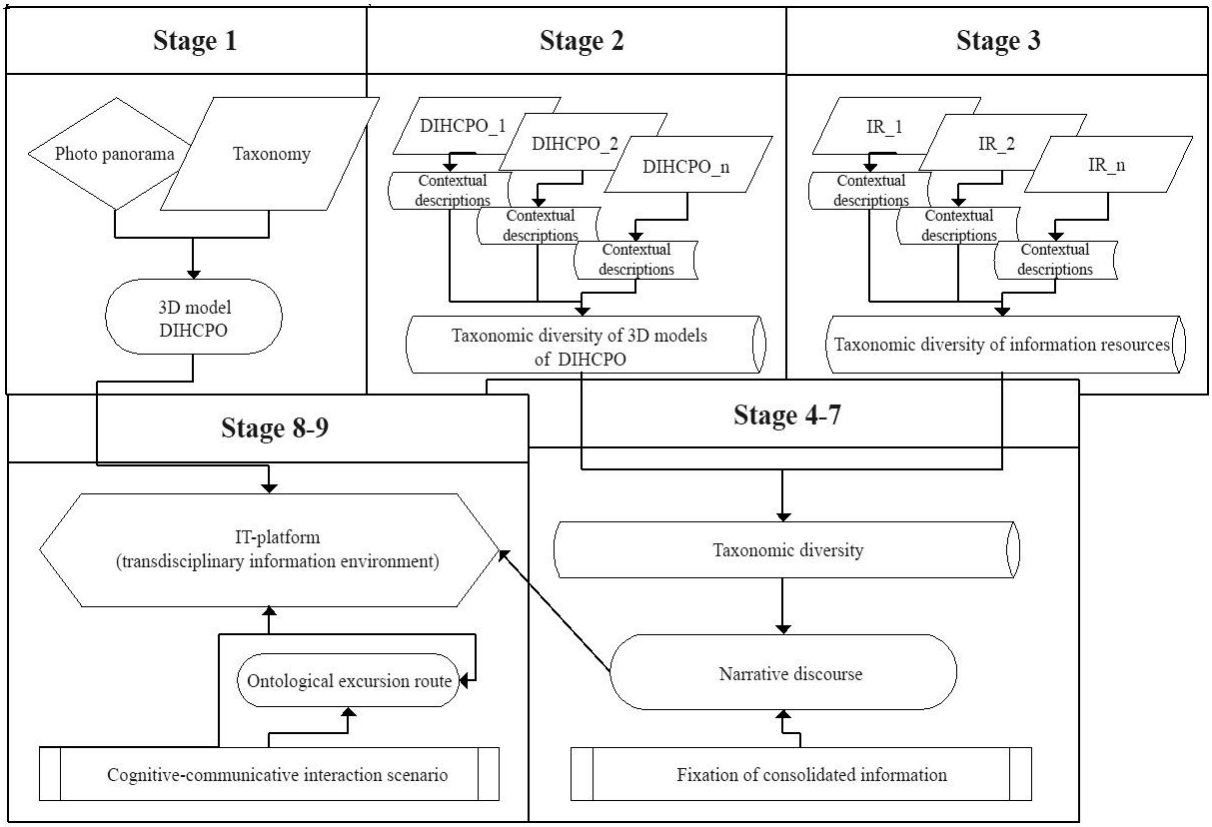

Fig. 2. Method of transdisciplinary consolidation of network information resources and knowledge systems of meaningful reflection of historical and cultural heritage

1. Creation of the 3D-models of heritage objects with photo panoramas and corresponding taxonomies of their structural representation.

The presentation of the object of preservation of historical and cultural heritage begins, first of all, with its visualization with the subsequent construction of a three-dimensional model. This process consists of photographing the object, processing and arranging images, creating final files, after which equiangular projections to form a continuous seamless panoramic image are created, and then stitching a series of original photos: bringing them to a form suitable for stitching (cylindrical or spherical projection); the process of stitching itself (combination of identical elements in adjacent common areas of images);

mixing images to equalize their brightness, contrast and color tone. The last stage of 3D-modeling of the object of preservation of historical and cultural heritage is the combination of a series of ready-made 3D-panoramas in so-called virtual tours or walks, where the transition from one panorama to another is through active zones placed directly on images as navigation elements and/or floor plan.

In parallel with the process of visualization of three-dimensional DIHCPOs, taxonomies of structural representation of their content are created. At this stage, from the narratives of nature-language descriptions of the meaningful reflection of historical and cultural heritage by means of semantic-linguistic analysis of texts the concepts that feature the elements of heritage preservation (exhibits, artifacts, documents, etc.) and are based on common properties are derived. The knowledge presented in the taxonomy acts both as a structure and as a meaningful content of the information model of the object of heritage preservation.

To record the acquired knowledge, it is necessary to determine the appropriate formalism that provides their visual and convenient presentation, as well as methods that allow this formalization. Such a formalism is a combination of algebraic-logical and axiomatic methods.

2. Formation of taxonomic diversity from contextual descriptions of DIHCPO.

Since the three-dimensional model of the heritage object may consist of several 3D panoramas, each of which visualizes the elements represented by a particular taxonomy, their totality forms a variety, i.e. a certain hyper-set of taxonomies, each of which in the formation of ontology DIHCPO is characterized by the inclusion of certain sets of axioms which differ from each other. These axioms are defined on the basis of the interpretation of the meanings of contexts, which in turn define the concepts of taxonomy and later ontology. Since we define the contexts of taxonomic nodes as elements of

certain knowledge, then their totality reflects the knowledge of the object of preservation of historical and cultural heritage, which is a holistic system of knowledge about the processes, facts, events and phenomena of history and culture.

3. Establishing intertextual relationships between taxonomies of 3D panoramas and the taxonomic diversity of relevant information resources.

Consolidation of distributed network information resources of meaningful reflection of historical and cultural heritage is realized on the basis of inter-contextual relations established between the concepts of their taxonomies, which, in turn, form a taxonomic diversity. That is, the consolidation of information resources is a verbal-active function that implements the interpretation of many binary relationships between all contexts, which reflect the meanings of concepts that form the content of subject areas whose information resources are involved in network interoperation.

Thus, the contexts of the concepts of the thematically defined set of distributed network information resources of meaningful reflection of the historical and cultural heritage are consolidated in the form of the novel taxonomic diversity.

4. Encapsulation of interactive taxonomies of the 3D panoramas in the taxonomic diversity of information resources.

Taxonomic diversity of consolidated taxonomies of the 3D panoramas with taxonomic diversity of thematically defined information resources of meaningful reflection of historical and cultural heritage forms a knowledge base that combines narratives of descriptions of processes, facts, events and phenomena of history and culture. Therefore, in the environment of such a knowledge base, the encapsulation of interactive taxonomies of 3D panoramas into the taxonomic diversity of information resources is realized by establishing

intertextual connections between the contexts of the concepts of taxonomies of DIHCPO and taxonomies of information resources.

5. Encapsulation of taxonomies reflecting thematically defined network information resources to taxonomic diversity.

Similarly to the previous stage, the encapsulation of taxonomies that reflect thematically defined network information resources to the novel taxonomic diversity, formed by consolidating the contexts of the concepts of taxonomies of DIHCPO and taxonomies of information resources, is implemented.

6. Generation of the format of narrative discourse on the basis of the formed novel taxonomic diversity.

Verbal-active reflection, on the basis of which taxonomic diversity is realized, is a narrative discourse that determines the inter-contextual coherence of the concepts of taxonomies of DIHCPO and thematically defined network information resources of meaningful reflection of historical and cultural heritage. Thus, the discourse is represented through a cognitive-communicative act that simultaneously implements the consolidated use of narratives describing taxonomic diversity and their interpretation in the form of visualization in the 3D panoramas. Thus, the cognitive-communicative scenario of interaction with the consolidated network information resources of meaningful reflection of historical and cultural heritage is realized by the means of taxonomic diversity and the format of narrative discourse.

7. Fixation of consolidated information based on integrated taxonomic diversity.

New knowledge about the processes, facts, events and phenomena of history and culture generated during the implementation of the cognitive-communicative scenario of interaction with consolidated network information resources of meaningful reflection of historical and cultural heritage can be

recorded in the context of taxonomic diversity concepts and included in narrative discourse format.

8. Formation of a transdisciplinary information environment in the format of narrative discourse based on the implementation of a cognitive-communicative scenario of interaction with consolidated network information resources of meaningful reflection of historical and cultural heritage.

Since the use of consolidated network information resources and knowledge systems of meaningful reflection of historical and cultural heritage during the implementation of cognitive-communicative scenario of interaction is considered in the format of system-integrated various information resources, which together are endowed with completeness, integrity, consistency and subject areas, and the format of narrative discourse in some way implements their systemological organization, it allows to form a single transdisciplinary information space DIHCPO.

9. Synchronization of an ontological 3D-model with functions of network service, in particular geo-information environment, with the purpose of the ontological excursion route formation.

The nodes of the concepts of taxonomic diversity of DIHCPO, grouped into classes based on the certain properties, correspond to the geographical objects in the environment of the geographic information system, which belong to the thematic layers of the map. In this case, the names of the concepts are identical to the corresponding names of geographical objects, and the names of the classes are identical to the names of the thematic layers. Actually, the taxonomy (or its fragment) can serve as a legend of the map. Thus, the elements of the knowledge base of the ontological 3D-model DIHCPO are visualized in space due to the functionality of the consolidated network service, in this case - geo-information. In the process of realization of the cognitive-communicative scenario of interaction with the consolidated DIHCPO the

taxonomy of the ontological excursion route is visualized in the environment of geographic information system, and access to network information resources is carried out through a fragment of a 3D-panorama of a three-dimensional model of a heritage object. In the case of regeneration of the ontological route due to the update of taxonomic diversity, the concepts of taxonomy of the ontological 3D-model DIHCPO are synchronized with the map objects in the GIS environment.

Ontological IT platform for transdisciplinary consolidation of 3D-panoramas with network information resources for meaningful reflection of historical and cultural heritage

On the basis of the offered models and the method the cognitive-communicative scenarios of interaction with the consolidated DIHCPO (fig. 3) in the environment of the ontological IT platform of display of virtual museum expositions "Museum Portal" are implemented. Its elements are:

- Three-dimensional models of historical and cultural heritage sites, including virtual tours of 3D panoramas of DIHCPO.
- Taxonomies and taxonomic diversity of narrative descriptions of elements of historical and cultural heritage preservation sites with consolidated thematically defined network information resources in the format of narrative discourse.
- Cognitive-communicative scenario of interaction with consolidated DIHCPO and network information resources of meaningful reflection of historical and cultural heritage through an improved ontological interface.
- Consolidated network services of analysis of information resources (their indexing, categorization and selection of the most relevant user queries), the formation of cognitive-communicative scenario and visualization of its stages in the form of interface elements and objects in the GIS environment.

The ontological IT platform for displaying virtual museum expositions "Museum Portal" provides increased efficiency of research tasks during the

implementation of cognitive-communicative scenario of interaction with network information resources of historical and cultural heritage content representation by consolidating them and using analytical capabilities of consolidated network services, in particular geographic information systems of various levels and purposes, in a single transdisciplinary multifunctional ontological-controlled system.

Consolidation of network information resources of meaningful reflection of historical and cultural heritage ensures the efficiency of the user's relationship with the source of information, adaptation of its presentation to the speed of its assimilation by the user, taking into account the thematic profile and individual characteristics of the latter. In particular, the thematic certainty of consolidated information resources ensures the minimization of information noise, appropriate dosing of information and its usefulness, accessibility (clarity) of its presentation, which significantly increases the efficiency of information use. The speed and quality of solving research problems during the implementation of the cognitive-communicative scenario of interaction in the environment of the ontological IT platform for displaying virtual museum expositions "Museum Portal" increases by presenting not only information that directly describes the objects of historical and cultural heritage, but also narratives descriptions of processes, facts, events and phenomena from other fields of knowledge.

The use of the ontological IT platform for displaying virtual museum expositions "Museum Portal" in the process of implementing cognitive-communicative scenarios of interaction with consolidated DIHCPO allows to significantly expand the image of world civilization, interdisciplinary links between history and culture, science and technology, science and modern technologies by generating new knowledge by means of consolidated network information resources and services of multi-criteria analysis and search of semantically connected information arrays, and visualization of their results, in particular in GIS. This combination allows creating a single transdisciplinary environment for user interaction with consolidated network information resources of meaningful reflection of historical and cultural heritage, which provides automatic encapsulation of the latest DIHCPO.

The ontological IT platform for displaying virtual museum expositions "Museum Portal" provides support for interaction with consolidated network information resources in the process of acquaintance, study and research of historical and cultural events, facts and phenomena in the format of a single scientific and educational environment "Museum Planet" provides:

- consolidation of distributed narrative descriptions of objects of preservation of historical and cultural heritage and their presentation in a single environment of the "Museum Portal", which reduces the search time and increases the efficiency of information use;
- seamless integration of information systems of objects of preservation of historical-cultural and documentary heritage (electronic libraries, archives, descriptions of museum funds, thematic web-portals, etc.) for the purpose of creation of the uniform environment of research activity;
- ontological management of information arrays, the narratives of which form a single information space - an IT platform for displaying virtual museum expositions "Museum Portal";
- localization of objects of historical and cultural heritage in the environment of geographic information system for formation of ontological virtual routes of excursions;
- visualization of DIHCPO by means of the improved ontological interface for realization of cognitive-communicative scenarios of interaction with 3D-panoramas of the museum expositions consolidated with network information resources.

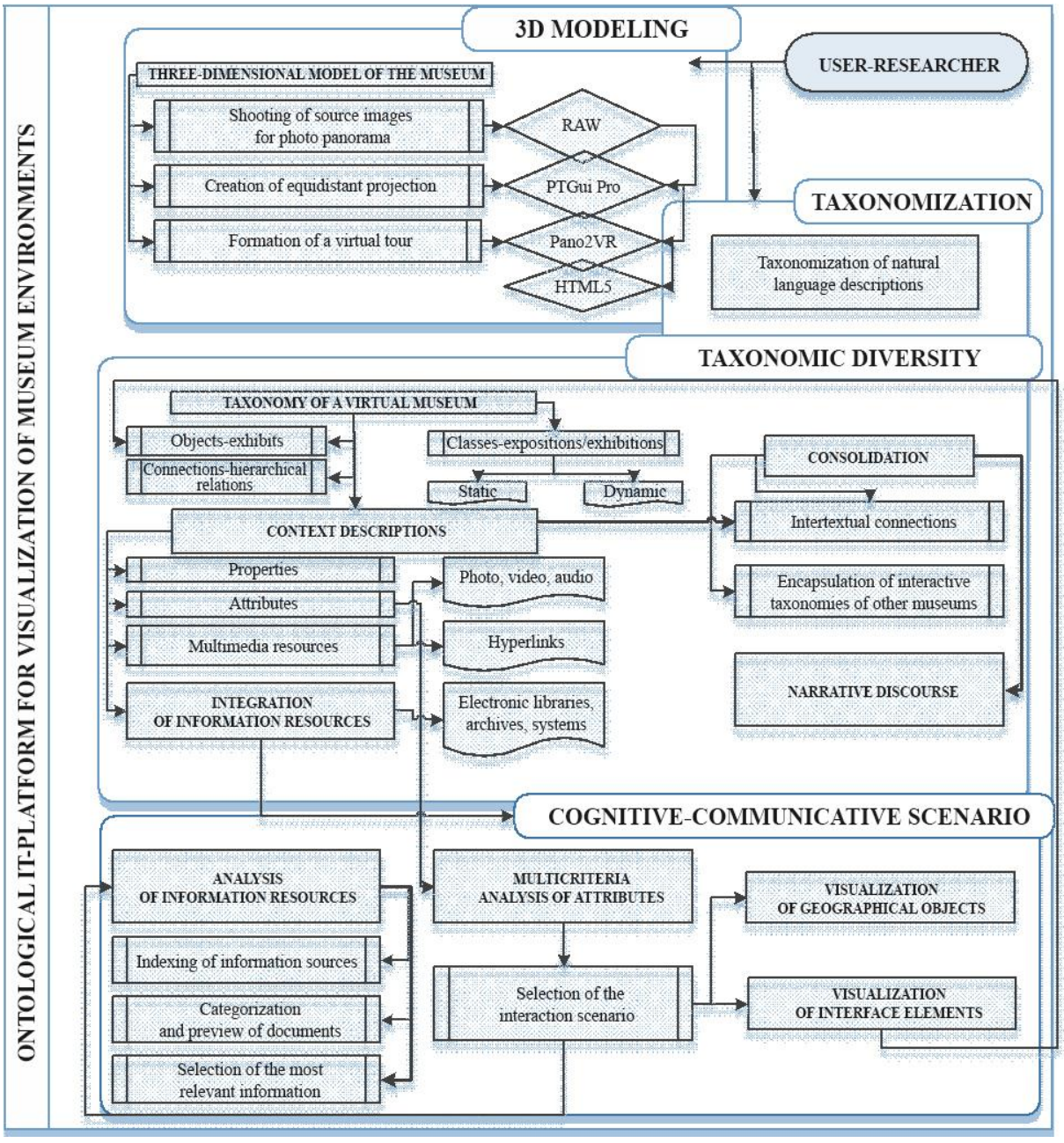

Fig. 3 The generalized scheme of the cognitive-communicative scenario of interaction with the consolidated DIHCPO

Conclusion

Improved model of ontological interface as a means of forming a cognitive-communicative scenario of interaction with consolidated digital images of historical and cultural heritage, which reflect digital narratives of descriptions of exhibits, which, unlike existing ones, provides a single system-organized information museum space.

A method of transdisciplinary consolidation of network information resources and knowledge systems of meaningful reflection of historical and cultural heritage in the environment of virtual museum expositions has been developed, which, in contrast to the existing ones, implements the process of forming a single systemologically organized museum space.

An ontological IT platform for transdisciplinary consolidation of 3D-panoramas with network information resources of the historical and cultural heritage content representation "Museum Portal" has been developed to support user interaction in the study of historical and cultural events, facts and phenomena in a single scientific and educational environment "Museum Planet", which, in contrast to the existing ones, implements automatic encapsulation of the latest digital museum images.

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Information about the author

Andrii Honchar *– National Center "Minor Academy of Sciences of Ukraine", 04119, Ukraine, Kiev, st. Dehtyarivska, 38-44; e-mail: avhonchar@gmail.com*

Major Fields of Scientific Research: 3D Visualization Technologies, VR, DB Integration