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Review article

ARTEFACTOMETRICAL ASSESSMENT OF WORKS OF ART BY SUMMING THE IMPACT GRIDS OF ALTMETRIC QUANTIFICATION

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Abstract:
The work takes into account the impact grids of the altmetric cuantification by summing which allows the evaluation of the share of the stock exchange or catalog of a work of art. For this purpose, the artefactometric criteria used in the hoarding of works of art are used by involving scientific expertise, such as: archaeometric authentication, patrimonial determination of the value share (by adding up the quantification grids), establishing the state of conservation by assessing the damage of the structural-functional elements and of the degradation of the nature of the component materials and, respectively, the development of compatible protocols for preservation, restoration and display in museums/ collections through modern and attractive systems. In the investigation of a work of art, in addition to the aesthetic-artistic analysis and the establishment of characteristics regarding the state and patrimonial functions, modern analysis techniques are involved in a system of corroboration and interdisciplinary co-assistance, which allow the identification of archaeometric and chemometric characteristics, with value archaeometric, determining the nature of the materials and their state of conservation and establishing the value quota by involving the impact grids, unanimously accepted, both for the artistic expertise and other characteristics related to the state of conservation, age, artistic technique and the technology of putting the work into operation, implicitly the nature of the old materials and the traditional operations used.

1. Introduction

Altmetrics is a relatively young field, derived from scientometry (the science of sciences), as a necessity of commensuration and other products of human creativity. It is known that the first ISI Thomson scientometric evaluation system was developed after 1962, taking into account scientific journals (*Web of Science*), monographs, treatises and patents (*Derwent Innovation Index*), monitoring the performance of research activity for individuals and legal entities, then later, in 1996, the Elsevier Editorial Group laid the foundations of the *SCOPUS* system, both of which are currently unanimously accepted

in the evaluation of journals, scientists and institutions with a research, development and innovation profile (*CDI*) [1-4]. Currently, in addition to many international databases (*BDI*), there are a large series under development (*CEOL, Index Copernicus, DOAJ, EBSCO, Chemical Abstract, Academic Google*, etc.), many with an access fee, others without [5-8]. In 1997, after the development of the first university specialization in the Science of Conservation of Cultural Assets in our country, a very attractive research topic was initiated related to the evaluation of works of art through the scholarship or catalog quota [9-14]. Since in such an approach both the heritage elements and functions had to be involved, the state of preservation in correlation with the age and the previous preservation-restoration interventions, but also the authentication attributes evaluated by archaeometric and chemometric characteristics, with archaeometric value [15-17], but also the criteria of the aesthetic-artistic analyses, of the routes traveled by the work of art and its historical contexts, etc. an altmetric evaluation system was used by adding up the impact figures of all evaluation grids [18-22]. In the paper, starting from the current systems of ranking and classifying works of art, an example of altmetric quantification of old paintings and other cultural heritage artifacts is presented by summing up the figures or impact factors of all the quantification grids through value credits.

2. Artefactometric Indicators

2.1. *Patrimonial elements and functions*

In the valorization of artefacts and in the discussion of authentication attributes, a series of characteristics are used in an artefact related to the heritage elements, which can come from the commissioning, but can also be acquired and respectively the heritage functions, which are usually acquired over time [20-24]. The first group includes: ***)** *the conception* (material, artistic technique, installation technology, size/gauge/complexity, finesse/degree of elaboration/ detailing); ***)** *the age/patina of time* (archaeometric and chemometric characteristics/ structures of the three patinas: noble or primary, poor or secondary and contamination or tertiary); ***)** *dating* (year/period); ***)** *the author* (school, workshop, disciple); ***)** *the geographical area* (the place of commissioning and use); ***)** *the unique attribute (*uniqueness*), copy/ replica, series/position;* ***)** *the originator/ original attribute and the authentic attribute.* The second group (Related to the patrimonial functions), they are grouped into: ***)** *aesthetic artistic (the function that allows inclusion in a collection or display in a museum);* ***)** *historical documentary (provides information about the era and its society);* ***)** *technical-scientific (information about the cultural and technological level);* ***)** *socio-economic, administrative/building (other uses and implications throughout history until now);* ***)** *spiritual (the highest function, related to the primacy of the work, the degree of novelty of artistic techniques, style etc.)*

2.2. *Artifact trails*

Artifact trails cultural and historical goods follow different routes from the commissioning to the museum, with well-defined historical contexts, such as phenomenon, form - aspect etc. Among the routes traveled by an artifact, it can be mentioned [15,16, 21-23]: ***)** the *normal* one, common to many works of art or monuments (stages from commissioning to museum or collection); ***)** by *abandon*, when the functions of use are lost; ***)** by *theft* and discovery; ***)** by *hiding* and forgetting (treasures, jewelry, money etc.); ***)** by *loss* (jewellery or small artifacts); ***)** *through bad weather or natural calamities* (floods, landslides, earthquakes with debris, volcanic eruptions, explosions etc.); ***)** *through catastrophes or anthropogenic disasters* (explosions, wars, revolutions,

collapses, diving etc.); ***)** *through plagues -cities and long-abandoned monuments* (the pyramids and temples of the Mesoamerican civilization, for which there is no universally accepted theory to explain this collapse (overpopulation, foreign invasions, popular uprisings, as well as the collapse of key trade routes, the ecological hypotheses that include environmental disasters/drought, epidemics and climate change etc.).

2.3. *Typology of historical contexts*

An artifact crosses a series of historical contexts, which remain on display imprinted in its form and appearance, respectively in the conservability and the message conveyed by it. Thus, the following causal series can be gradually realized: the context of the creation (the conception/primary form of creation), the manufacture or commissioning, the use/exhibition, and for some the abandonment and the discovery, as finally for the majority we have the preservation, restoration and reintroduction into the circuit of values [15,16,21-23]. The context of the discovery includes: ***)** Discovery mode (through systematic archaeological excavations, by chance after agricultural operations, construction excavations, landslides, in alluvium or after floods, in old galleries or in those carried out by wild animals etc. and following poaching traces without exhausting the site); ***)** *Photofixing* and *making the stratigraphic relief* on treading levels (stratigraphic positioning and 2D planimetric survey); ***)** *Determination of the physico-chemical and microbiological level* of the soil, along with the determination of the chemical compositions and archeometric characteristics of the internal structures (crevasses, patches, crackles, interfacial defects, diffusion and penetration zones etc.) and of the surface (products of the three age patinas, well highlighted in superficially corroded metal artifacts, with or without a metal core, for example: noble or primary, poor or secondary, contamination or tertiary patina, which can be in the form of zonally, continuous layer, thin layers sound crust form, dirt deposits etc.; ***)** *Evaluation of structural or compositional transformations/processes/ effects*, with the determination of the evolution between abandonment and discovery (pedological effects), the identification and evaluation of archaeometric characteristics for the establishment of heritage elements and functions prior to abandonment.

2.4. *Conservation levels and priorities*

Due to the very intensive handling, which leads to various degrees of deterioration and degradation (such as wear and tear due to use or deterioration due to storage and supervision conditions), in most national archives and large libraries the book holdings, documents, manuscripts etc., are grouped together on conservation states, in correlation with intervention priorities through preservation and restoration operations. Starting from this aspect, five conservation levels were introduced for old cultural heritage artifacts, with their valorization priorities [15, 16,21-23].

Level I, which includes goods of special patrimonial value that present a precarious state of conservation, which include unique items, treasured goods or very valuable goods that do not allow display due to certain historical, political, ideological, religious etc. considerations or value-related, as strict safeguards. This level includes two subgroups: ***IA*** or the closed level, to which only scientific conservators have access, because they require urgent active conservation and restoration interventions, and ***IB*** or the open level, to which experts in art, historians or documentarians have access, along with scientific conservators and curators, with special approval.

Level II, which includes heritage assets of great value, but with a relatively better state of conservation, to which they have access, together with curators and various specialists for documentation. The goods can be included in the museum circuit through scientific replicas or under special protection and after a prior preventive or prophylactic

consolidation and an appropriate active preservation intervention.

Level III, which includes well-preserved heritage goods that can be displayed in museums and that, can participate in traveling exhibitions. The goods can be handled, packed and transported; moreover, visitors can have direct access to them.

Level IV refers to heritage goods existing in several versions or replicas, in the form of a surplus stock, which can participate in the exchange of values between collections.

Level V represents the gray fund, which includes heritage assets with damage and irreversible degradation, in collapse, with a state of conservation between 0.5 and 10% (depending on the type of asset), due to which no longer they can be exposed/ displayed. These goods are kept for use as teaching material and in experiments. It is recommended that they be kept in special warehouses, in air-conditioned conditions, so as not to be damaged or degraded further. Under no circumstances will they be destroyed or removed.

2.5. *Processes and formation mechanisms of archaeometries characteristics*

Based on the mechanism of electrochemical corrosion processes with electrodes of the same nature, with a single electrode (based on adjacent structures or in contact with different electrochemical potentials) or with two electrodes (encountered in anodic and cathodic protection) and those of selective corrosion, elucidated the processes of changing the basic structure by reformulating the composition of alumino-silicates from ancient ceramics, following alkaline dissolution through the diffusion of hydrocarbonate ions during the period of rest, with the formation of substitution meshes with aragonite [25-32], the formation of mineralization structures of structural elements of an organic nature (wood, leather, cellulosic or collagenous textile fibers etc.) through the monolithicization with corrosion products of ancient bronze or iron parts and of substitution ones with differentiated morphologies and distributions in the volume phase of metal parts without a core metallic, the formation mechanism of Liesegang rings [33-38] from the corrosion structure of ancient bronzes, by the presence of fluoro or hydroxoapatite pelliculogenic hydrogels and Sn(II), Zn(II) and Pb(II) oxohydroxides –[39-45]. Regarding the Liesegang effect, the stratification differentiated by types of compounds (congruent) of the corrosion bulk resulting from deposition period in the archaeological site, is due to the oxyhydroxide compounds of Sn(IV), Pb(II) and Zn(II), which in certain hydrothermal conditions give pelliculogenic nano-structures formed by continuous and uniform hydrogels on the surface on adhesive supports, with osmotic membrane properties. These, following some acid-base, aqueous dissolution and complication processes under the membrane, lead in drying conditions to the outside of the membrane, to the differentiated stratification of a certain compound, previously formed from the primary or secondary structure. Thus, the tertiary layer of contamination is formed, through processes of osmosis or in certain cases of electroosmosis during homo-precipitations or recrystallization of new congruent structures. A main role in these processes is played by the chloride anion, which together with the hydroxide anion and the hydronium cation creates conditions for the precipitation or crystallization of certain salts of Cu(I and II) ions in the form of successive layers [31-37]. The chloride anion, together with the hydroxide anion and the hydronium cation, generate compounds from the secondary structures, which emerge from under the primary patina in the form of bumps, concretions, vesications etc. with evolution over time, until the total destruction of the primary patina [38-45]. Studying a series of ancient

bronzes, three types of structures were highlighted in their corrosion crust [36,37,41, 44]: **a) *primary*** - formed during the period of commissioning and use of the object, through redox processes of a chemical nature (oxides, sulphides etc.), some in the form of continuous and uniform films, forming the noble patina; **b) *secondary*** - results, starting from the final phase of the period of use and continuing with the initial phase after abandonment, following electrochemical redox processes, assisted by acid-base, ion exchange, hydrolysis (oxyhydroxides, oxy- or hydroxysalts, halogens, carbonates, sulfates, phosphates etc.) and sometimes thermal ones (calcinations, re-crystallizations etc.) following incineration and anthropogenic or natural fires, which form poor patina; **c) *tertiary*** *or contamination patina,* formed in the archaeological site, under the influence of pedological, chemical and microbiological processes (segregation, diffusion, osmosis, monolithization, fossilization, hydration/dehydration mineralization, structural reformation etc.). The three types of structures are identified, both in the pieces from disturbed sites and in the undisturbed ones.

3. Dating using Archaeometric and Chemometric Characteristics

A series of methods are used in the dating of an old, recently discovered or less studied artefact, with instrumental techniques in a coexistence or interdisciplinary corroboration system. They take into account the nature and the preservation state of the component materials, form, style, complexity and other structural features. Archaeometry, as a science is related to the study of evolution in time and space, uses a series of characteristics in dating, for which there are reference standards [15,21-23]. Among the new methods carried out within our collective we mention [46-51]: ***)** The use of the two chemometric characteristics of the normal range of variation of the water balance: the maximum or minimum limits (of the absorption curve through hydration and of the desorption curve through dehydration or desiccation) and the point of intersection of the two curves. The latter being a characteristic specific to the essence of wood, the age of the tree, the age of the wood, the place of cutting from the trunk and the period or area of harvesting, has multiple practical implications: in dating and in evaluating the impact of preventive preservation interventions. The normal range of variation of the water balance varies with the reversible hygroscopicity of a material in relation to the humidity of the environment and which does not affect the chemical, physical-structural, mechanical and dimensional characteristics of the object of which it is a part. The critical correlation point of the water balance (the intersection of the adsorption and desorption curves of hygroscopic water is determined from the graphical representation RMC = f(t), with the limits of the domain between the maximum value RMC = ΔEMC and the hypothetical minimum RMC = 0; ***)** For old wooden supports (panels, chassis, frames and frames or casings), a series of archaeometric characteristics related to the degree of penetration of dirt deposits and patina, porosity, crystalline cellulose concentration and residual weight were used in dating of ash, along with the dendrochronological method, with the corrections of the scales for the thickness of the annual rings, and among the chemometric ones were: the wood shrinkage ratios in the three directions: L (longitudinal), R (radial) and T (tangential), respectively ΔT/ΔL, ΔR/ΔT and ΔR/ΔT; concentration remaining in crystalline cellulose; the remaining concentration in volatile components; ash concentration and others; ***)** For cellulosic textile supports white matter, glycolysis rate, ratio of carbon/oxygen content (C/O), carbon/hydrogen (C/H), organic carbon/nitrogen (C/Norganic), pH/Humidity, Nmineral/Ash, ratio between extractive components and hygroscopic

moisture etc.; ***)** For the pictorial material supports: protein, lipid and carbohydrate markers, the type of cracks, the stratigraphic distribution of the pictorial materials, the penetration degree of dirt deposits and patina, the degree of diffusion between layers, the porosity gradient regarding the penetration from the surface into the volume phase of colors, touch, age patina, chromatic displacement (ΔEab*), archeometric ratios between the chemical elements of the pigments (Pb/C, Zn/C, C/S etc.); ***)** For varnishes: rate of encrustation or deposits cornification and organic markers of degradation, type of cracks, stratigraphic distribution, degree of blackening or chromatic deviation (ΔE_{ab}*); ***)** For primers or preparations: rate of embrittlement and sponginess, binder degradation markers, stratigraphic distribution etc.; ***)** For ancient ceramics: nature of chemical components, granulometry and stratigraphic arrangement, porosity, specific gravity, ratio between Si/Al, Ca/Mg and Na/K. Among these methods, two applied to old cellulosic supports, have been patented and homologated: the determination of the degree of whiteness, which involves the leukometric or spectrophotometric technique by reflection CIE L*a*b* for the determination of the degree of whiteness by extrapolation using specific graphs of various cellulosic supports papers obtained by artificial aging and, respectively, the rate of glycolysis, with the help of intrinsic viscometry, when the degree of polymerization of the cellulosic or protein fiber is determined, and based on this, the rate of glycolysis is evaluated, which varies proportionally with the age. The standard curves were obtained by artificial aging [48,51-61].

4. Heritage Evaluation Criteria of Old Paintings and Other Artefacts

Starting with the year 1993 and until 1998, an important research direction of our group was related to the establishment of evaluation criteria through the share of the stock exchange or catalog. For paintings, sculptures and other works of art, taking into account the unanimously accepted criteria in numismatics, philately and cartography, three levels of quantification were proposed, presented in tab_s. (1, 2 & 3). Moreover, in the patrimonial classification, for banknotes, cartophile and philately: unobliterated/obliterated, unveiled/veiled, fragment, on support (envelope, document etc.), the so-called Michel Quotas are used.

Table (1) The patrimonial grouping system a historical artifacts and art objects (*Method of aesthetic-artistic and technical-scientific assessment*).

Class	Level	Quota	Value group
A	Worldwide	10^6	Thesaurus
		10^5	Inestimable
		10^4	Very valuable
B	National	10^3	Valuable
		10^2	Common
-	0	10	Kitsch

Table (2) The patrimonial classification system by evaluation of the unique qualification a historical artifacts and art objects (*Uniqueness method*).

Class	Level	Quota	Qualification	Value group
A	Worldwide	10^6	Unique	(U)
		10^5	Extremely rare	(I)
		10^4	Very rare	(FR)
B	National	10^3	Great rarities	(RR)
		10^2	Rare	(R)
-	0	10	Frequent or high series/ussual	(C)

Table (3) The patrimonial classification system by assessment of the conservation status a historical artifacts and art objects (*Conservation state method*).

Class	Level	Quota (%)	Qualification	Value group
A	Worldwide	100	Uncirculated/immaculate (proof)	(N)
		90	Very beautiful (Excellent)	(X)
		80	Beautiful (Extremely fine)	(FR)
B	National	70	Very well preserved (Fine)	(F)
		60	Well preserved	(U)
		50	Medium preserved	(M)
-	0	40	Poor state of conservation	(P)
		≤30		

5. The aesthetic-artistic evaluation criteria and the method of calculation through the qualification grids

In the heritage assessment for paintings, sculptures and other works of art, the criteria are quantified by points (credits or impact

index), specific to each one, which according to the complexity, importance in the fundamental analysis, content, hermeneutic, intrinsic value and the exhaustive (the evolution of the indicators), they are grouped into six scales: **a)** from 1 to 10 points; **b)** from 10 to 100 points, **c)** from 100 to 1.000 points, **d)** from 1.000 to 10.000 points, **e)** from 10.000 to 100.000 and **f)** from 100.000 to 1.000.000. Seven criteria are used in the analysis, as follows: ***The aesthetic-artistic value***, which includes 30 grids, quantified by specific credits, is shown in tab. (4).

Table (4) The aesthetic-artistic assessment criteria.

1. Chromatic complexity in primary, secondary and tertiary colors (**Scale C**)	**16.** Internal resonance of lines, dots and color spots, as a Kandinski effect (**Scale C**)
2. The equation of color surface volume (Scale B)	**17.** Involvement of plastic language elements (**Scale C**)
3. Resistance of the color and vivacity of the varnish, polishes or ornaments (**Scale A**)	**18.** The concordance/discordance ratio (**Scale B**)
4. Refinement of chromatic chords and discords (**Scale B**)	**19.** The relationship between linear and chromatic in the iconographic pictorial context (**Scale C**)
5. The choice of chromatic dominants	**20.** Closed/open form of compassion (**Scale A**)
6. Equation of complementary and intermediate shades (**Scale C**)	**21.** Simplicity/complexity of compositional schemes (**Scale B**)
7. Expressiveness of colors and their symbolic values (**Scale C**)	**22.** Placement of singular elements within the compositional scheme (**Scale B**)
8. How to use background colors close to neutral and decorative virtues (**Scale B**)	**23.** How to achieve the reverse perspective, rendering the space and content elements (**Scale C**)
9. The sobriety/vivaciousness of colors, how to develop gradients (**Scale A**)	**24.** The involvement of declarative motifs and clothing, with the degree of their reproduction/ reproduction (**Scale C**)
10. The juxtaposition of the tonal steps for the same shade, in the sense of their increase- decrease (**Scale C**)	**25.** The absence/presence of drawing elements and the highlighting or not of the sketch sequences (their aesthetic-artistic value) (**Scale B**)
11. Elaboration by equal, homogeneous stretching and step amplification (**Scale B**)	**26.** Presentation of miniatures, watermarks and elements of graphic and chromatic symbolism (**Scale C**)
12. Light-dark alternation (**Scale A**)	**27.** How to achieve the elements of compositional rhythm, plastic rhyme and overall harmony of the work (**Scale C**)
13. Correlation between lights and shadows (**Scale A**)	**28.** Number of iconographic registers and characters/architectural and landscape elements (**Scale C**)
14. The purity or conciseness of the lines of force or of those of the contour (**Scale B**)	**29.** Number of iconographic registers and characters/architectural and landscape elements (**Scale C**)
15. Disposition of the force or active center (**Scale C**)	**30.** The depth and delicacy of the details, with the framing of the plastic/ drawing combination elements and the rendering of light, volumes and space (**Scale C**)

The primacy or original spiritual value (this also includes the theological-dogmatic value of ecclesiastical artifacts), given by the value as a treasure asset, primacy as a fundamental work for a style or effect, then for liturgical ones: liturgical role and importance, meaning spiritual and scriptural foundation and its implications. For example, when evaluating the spiritual function for ecclesiastical artifacts, the miracle-working goods and the credibility of the masses are taken into account. Multiple assessment using scales from d to f is used. *The value of the artistic and technological technique of putting the artwork into practice*, takes into consideration the style, the invoice and the originality of the creation, the author's demands and the artistic level acquired, the spiritual function - the degree of artistic novelty (opener of new concepts), then the technical scientific function and the historical one – documentary, in order to finally evaluate the primacy in the achievement and developpment of style - multiple evaluation by **scale c**. *The value of the materials and the cost of the operations involved in the commissioning - multiple evaluation* through the **scales a & b**. *Authenticity, uniqueness and the degree of rarity/multiplication* (copies, variants etc.) and that of novelty, the way and frequency of approaching the iconographic motif, the arrangement of colors and systems used in climatic and mechanical protection, the value of ornaments and frames - multiple evaluation by **scales c and f**. *The age of the artwork* always provides an impact figure that amplifies the value of the work with a ranking/qualification coefficient, called the age or seniority coefficient (cv), given by the relationship: $\mathbf{cv = v/10(1,2^{v/100})}$, where: **v** represents the age or age of the artefact - it applies to the final value summed up to this criterion; *The integrity and state of conservation* achieves a decrease in the value share (CV), given by the relationship:

CV = Summated Final Value x (100 - conservability).

This criterion also includes cleaning, varnishing/devarnishing, preventive consolidation, preservation and restoration etc. The conservability of the patina of time, dirt deposits, inappropriate repainting/falsification interventions, polishing and subsequent framing with ornamental elements are also taken into account.

6. Conclusions

Starting from the current systems of ranking and classifying works of art, unanimously accepted worldwide, an altmetric quantification system of old paintings and other artifacts of cultural heritage was developed by summing the numbers or impact factors of all the quantification grids through value credits, using artefactometric indicators validated through conceptual models. A special place was given to the 30 aesthetic-artistic criteria, elaborated within our collective and which were grouped on impact grids, with six groups of credits: from 1 to 10, from 10 to 100, from 100 to 1000, from 1000 to 10,000, from 10,000 to 100,000 and from 100,000 to 1,000000, depending on the complexity of the elements related to style, artistic technique, degree of innovation, the nature (value) of the materials and the implementation methodology and others. The work is addressed to museums, collectors, auction houses, antique shops, etc.

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