11th International Conference on Renewable Electrical Power Sources

PROCEEDINGS

Editor Dr Milica Vlahović

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on Renewable Electrical Power Sources

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FOREWORD

The conditions created by the development of technologies in which modern man lives have led to a complex and paradoxical effect: that by removing obstacles on the way to a more comfortable, simpler, faster and more efficient life and way of working, man also generates numerous misfortunes, attracting dark clouds of threats to the survival of the planet and humanity. The question that concerns and affects all of us - all people, all living beings, systems in which life takes place, large and small, strong and weak - boils down to the problem of the negative impact of man on the environment; this issue invites us to an urgent solution by looking at the causes, proposing solutions, evaluating them, changing approaches and ways of thinking, as well as drawing correct conclusions. Simply put, by adapting nature to one's own needs, man threatens and damages it. That is why, with the joint efforts of all of us, individuals, organizations and states, it is necessary to take all possible measures to immediately prevent the negative effects that are ahead of us.

The importance of renewable sources of electricity, which this international conference focuses on, is noticeable from two angles: the first - it is certain that fossil fuels as a resource will disappear and it is necessary to find alternative sources, the second - the use of renewable energy sources by its essence implies "clean" technology that significantly contributes to reducing CO_2 emissions and thus mitigating climate change and reducing pollution, while encouraging social and economic development in all spheres of life.

The 11th International Conference on Renewable Electrical Power Sources is organized by the Society for Renewable Electrical Power Sources (DOIEE) at SMEITS, with co-organizers: The Institute of Architecture and Urban & Spatial Planning of Serbia (IAUS) and the Chamber of Commerce and Industry of Serbia, with the support of the Ministry of Science, Technological Development and Innovation of the Republic of Serbia.

The registered participants designed their papers according to the given conference topics:
- Energy sources and energy storage;
- Energy efficiency in the context of use of renewable energy sources (RES);
- Environment, sustainability and policy;
- Applications and services.

Eminent authors - scientists, teachers, experts in this field from fifteen different countries: Algeria, Belgium, Bosnia and Herzegovina, China, Croatia, Greece, Hungary, India, Portugal, Saudi Arabia, Serbia, Slovenia, Spain, the United Arab Emirates, and Ukraine, contributed to the conference through sixty-nine papers that were reviewed by the Scientific Committee of the Conference, and after the review process were accepted for presentation at the conference and for publication in the proceedings.

At the end of this short message and at the beginning of the proceedings I believe that it can be proudly said that scientists, researchers, policy makers and industry experts gathered in one place, in order to exchange experiences and knowledge with the aim of promoting scientific and professional ideas and results of research, technology improvement for the use of RES, promoting the rational use of electricity, affirming and proposing inventive solutions in the field of sustainable sources of electricity.

Belgrade, *Milica Vlahović*
November 2023

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Energetski izvori i skladistenje energije:

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<u>Životna sredina, održivost i politika:</u>

Aplikacije:

SMART MATERIJALI I SAVREMENI KONTEKST ZA FUNKCIONALIZACIJU OBNOVLJIVIH IZVORA ENERGIJE U GALERIJSKOM PROSTORU

SMART MATERIALS AND CONTEMPORARY CONTEXT FOR THE FUNCTIONALIZATION OF RENEWABLE ENERGY SOURCES IN THE GALLERY SPACE

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Apstrakt

Razmatranjem novih studija o mogućnost primene smart materijala u muzejsko-galerijskim prostorima koji daju kontekst za neke savremene modele funkcionalizacije obnovljivih izvora energije, u ovom radu ispituje se univerzalnost deskripcije takvog konteksta. Metodološki, u korišćenju analitičkog aparata na relaciji principa Ars Inveniendi – Ars Combinatoria, rad je inspirisan Lajbnicovim filozofskim idejama.

Ključne reči: *obnovljivi izvori energije; smart materials; preventivna konzervacija; filozofija; tehnologija*

Abstract

By considering new studies on the possibility of implementing smart materials in museum-gallery spaces which give the context for some modern models of functioning renewable energy sources, this paper examines the universality of descriptions such context. Methodologically, in the use of an analytical apparatus on the relation principle of Ars Inveniendi – Ars Combinatoria, the work is inspired by Leibniz's philosophical ideas.

Key words: *renewable energy sources; smart materials; preventive conservation; philosophy; technology*

1 Introduction

The area of technical-technological research is as a rule to intended to formulament of universality, which in its essence is the opposite of the context. Asking the question, whether there is a rigorous and scientific concept of context, the French philosopher Derrida replies that the context as a theoretical insufficiency (l'insuffisance théorique) is never absolutely determined (absolument déterminables), or that it is practically and indeterminate, from which exist the necessarity derives of generalization, [1].

This is exactly characterized the approach that is necessary if the aim of the research is that one technical and technological phenomenon, such as renewable energy sources, contextualizes in the space that exceeds the possibilities of absolute technical determination. It is a space of artistic or museum gallery, which is meaningfully to be determined as the union made up of concrete technological, as well as abstract art spaces, reflecting the expressive function of symbolic meaning [2],

where the symbolic space is observed as a sub-space of the gallery physical area And as an artistic expression of the artist's inner creative space.

And modern scientific research indicate the possibility of seeing space in different registers, such as: „boundless, three-dimensional physical spaces; biological space as experience; constructs such as intimacy in social systems; and semiotic space as shared meaning", [3]. Here we also add one of the many possible registers, which refers to the logical space, because for our topic of the research is important from the aspect of defining symbolic functions, as well as contextualization of technical and technological aspects, [4-6].

The term contemporary context in this paper refers to modern technologies and materials that share the joint prefix Smart, as well as the modern movements in art, which give a broader mark of the spirit, known in science and philosophy as Zeitgeist, [7]. View into context as a product of synchronization of analytical and synthetic model of meaning and knowledge of gallery spaces, is aimed at description of the environment in which smart materials and renewable energy sources are applied. Here, in mind that the assessment theory supports the argument that contextual meanings in the data sets receive significant strength from evaluation process of the description of phenomena, [8]. Due to the scope of possible descriptive combinations, the analysis of the diversity and positioning of contextual meanings in the set of data on gallery space will be limited to the basic systemic level, in accordance with the spatial constraints of this paper.

2 Gallery spaces

We most often observe the artistic or museum galleries as a model consisting of an exhibition spaces [9, 10], where of which in standard cases, each individual space is personified by the *white cube model*, which represents a geometric, spatial and philosophical phenomenon, which is inspired by wrote Brian O' Doherty, [11]. As Thomas McEvilley points out, the word is about space „designed to eliminate awareness of the outside world, with specific limitations and conditionings", hence „…ideal space where the surrounding matrix of space-time is symbolically annulled, this is a institutionalization of the white cube, that relates exclusively to formal visual means…". It represents an emanation „…by our culture's attention to the unchanging abstraction of mathematics, the idea of pure form dominated the esthetics (and ethics) from which the white cube emerged …", and „ …The white cube's ultimate meaning is this life-erasing transcendental ambition disguised and converted to specific social purposes…", [12].

For O' Doherty gallery is a *perceptual constants,* „… Unshadowed, white, clean, artificial-the space is devoted to the technology of esthetics" with hidden energies*,* „…Esthetics are turned into a kind of social elitism-the gallery space is exclusive …". This is where the *context* is interpreted as *content*, there is a seepage of energy from art to its surroundings, the gallery as a legitimate place for discourse, [11]. However, when the discourse about the space comes to interaction with physical space, according to the concept of the French philosopher Foucault about the *discursive space*, the idea is materialized in space (architectural, urban and institutional) [13], and according to consideration by Mills, discourse variable dependent From context and represents a system that structures the way we perceive reality [14]. The British Theorist Doreen Massey also points out that it is important "... The way in which space is conceptualized, in intellectual work, in social life, and in political practice, matters..." [15], and very important to emphasize here, that the space ***per se*** in the postmodern discourse is different from space as social category, [16].

A man's relationship to gallery space is characterized by *visual attention* and *memory* [17-23]. For formalization of different aspects of space in the creation of this experience, modern science uses the method of Space Syntax [24], and the linking space syntax with spatial cognition (empirically proven) [25-26] and potentially with some aspects of human perception of space (such as a sense of spaciousness, openness and complexity.

Strives „…to define, measure, describe, and compare the human (aesthetic and visual) 'experience' (Fig. 1), Along the fence that such research is in the field of controversial terms with a long history of philosophical discussions, [27]. Methodologically, in addition to spatial syntax, the research of gallery spaces include the application of multivariate statistics [28], Integrations of visual

spatial of the information [29], as well as exploration of the generative potential of *isovist* fields, [30] (Isovist - a geometrical shape describing the area on the floor plan from which a given point is physically visible).

It is understood that the modern gallery should be associated with renewable energy sources, for what is one of the good examples *Jackson Foundation Art Gallery* (Fig. 2), "…a unique, ambitious, multi-award winning, carbon-negative art-space celebrating the relationship between art and the natural world", [32] . Data on installed sources on the object of this gallery are: Technology: Solar PV & Battery; System size: 24,85 kWp; Annual output: 24,230 kWh; Annual CO_2 savings: 14,526 kg. It also points out that solar panels usually create more pure energy than you can be used immediately, which is why the battery is installed. The power allows the gallery to store excess solar energy, increasing the use of clean energy and reducing relying on an expensive electricity purchased from the network, [31].

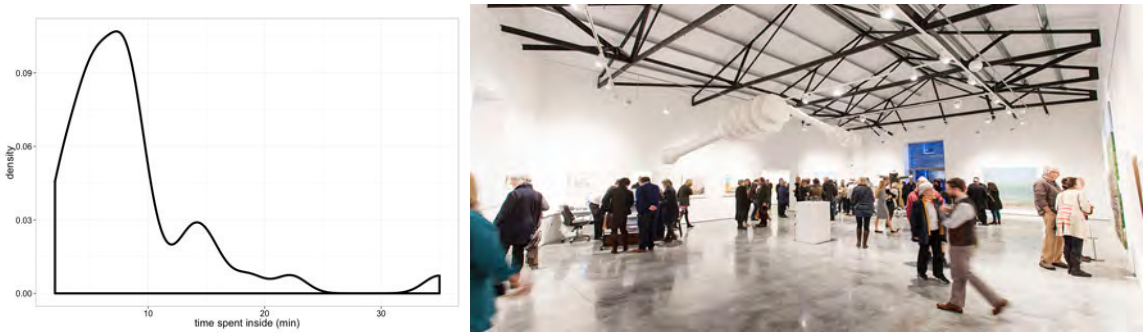

Fig. 1: Distribution of time spent inside the gallery by the experiment participants, [27]; Fig 2: Jackson Foundation Art Gallery, [32]

Modern art, however, in the public space, which has the function of the outdoor gallery, also introduces renewable energy sources, in sculptures that have both functional and industrial quality associated with artistic invention and expression, (Fig. 3).

Fig. 3. Outdoor Gallery: a - Spherical Sun Power Generator by Andre Broessel:"The Sun Power Generator is a structure that generates twice the normal amount of solar energy possible with a solar panel", [33]; b - Ondine by Elena Paroucheva:"The sculpture took the form of a woman with what seems to be jewelry around her neck and on her wrist. A closer look will reveal that the jewelry is a set of wind turbines.", [34]

3 Smart materials and renewable sources in the actantial context

If we view the art setting in the gallery space as the content structure of the event whose integrity build materials and technological funds in the coexistence with symbolically defined energy provided by Artifacts, then Smart materials, artistic applied materials, technical means of support and

the presence of man as body spatialities (multi - directional movement around individual objects, not in advance determined), they form a set of different and variable energy that cannot be described in the universal language and which is insufficient to consider only the technological parameters of energy and geometric configuration of space.

However, individually, these are phenomena characterized by the characteristic semantic ("Static" Level), Syntactic ("Dynamic" Level) [35] and semiotics, which is in the narrowest connection between technological and anthropological, ontological issues, [36]. For the stated factors in the gallery space, can be observed as a system that includes all three ways of existence from ancient ontology, Since this space contains the elements that exist materially, then ideal elements, but also the ideal elements intended by material quality, in relationships between subjective and objective. Therefore, for the context that should include these different aspects, research in this paper was directed to multidisciplinary tools that can be observed to the given phenomena, In the way that the semiotic structure and semantic pattern of discourse are related to its function, keeping the essence of the semiotic procedure to send encoded information to the recipient, as well as its decipherment and interpretation, [37].

To this end, we considered various multidisciplinary research models, and came to the method of actantial analysis, which has shown the most useful in such a given problem. It is about a generative and transformative method that has arisen in the field of structural semiology and whose foundation was appointed by Algirdas Julien Greimas. He created a semiotic square (Fig. 4a), as a theoretical tool that relates to the problem of labeling and manufacturing of meanings, i.e. the process of transposing language into the metalanguage, and as later proved, with the possibility of adjusting to different sciences, [38].

Research shows that the semiotic square is a means of refining opposite analyzes [39], by increasing the number of analytical classes stemming from a given opposition from two to even ten, where necessary to create an appropriate one in the analysis - metaterms by finding satisfactory lexicalisations for them where possible. Louis Hébert considers that the semiotic square implies the following elements: terms; metaterms (compound terms); object(s) (classified on the square); observing subject(s) (who do the classifying) and time (of the observation), with the note that „we are steering clear of the constituent relationships of the square: contrariety, contradiction, and complementarity or implication“ (Fig. 4b).

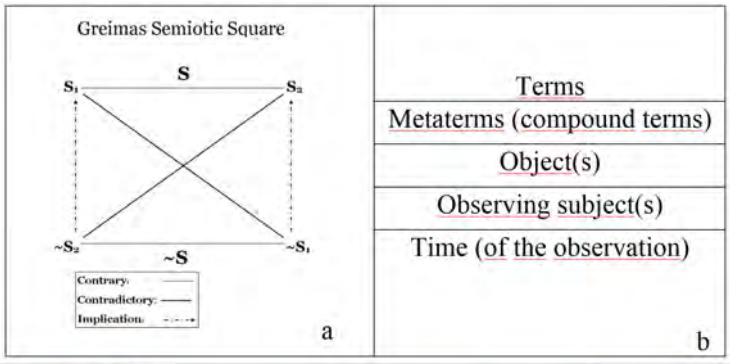

Fig. 4: Comparative view to Semiotic Square: a -Greimas,[40]; b- Hébert, [35.]

When it comes to materials, in this paper we talk about smart materials in the renewal of cultural and historical values of gallery spaces and modernization of industrial heritage that change the purpose and become gallery spaces. As she states Sheikholeslami with associates (based on the Addington & Schodek), smart materials characterized by the qualities that give them a distinct advantage in relation to classical materials: response is discrete and predictable (Selectivity), respond to more than one environmental state (Transiency); response is local to activating event (Directness), intelligence is internal to rather than external (Self - actuation) and respond in real time (Immediacy), [41,42].

On the other hand, in the gallery space are also present in artwork materials, which belong to a wide range, from classical to all known contemporary materials, which can be obtained as raw materials, or in processed condition, or even as part of waste or Recycled, and in that sense industrially processed, [43, 44]. A particularly sensitive group of materials consists of organic materials (plant species that grow on sculptures as part of the artistic process), or thermal-unstable materials such as wax or ice, whose melting is part of artistic expression. There are also hygroscopic materials, which in connection with the preservation of works of art require low humidity in space, where the hygrothermal impact of the human bodies of visitors in space is possible, and where exhibition spaces are not air conditioned, there are also different environmental influences to gallery spaces. [45], (Fig 5).

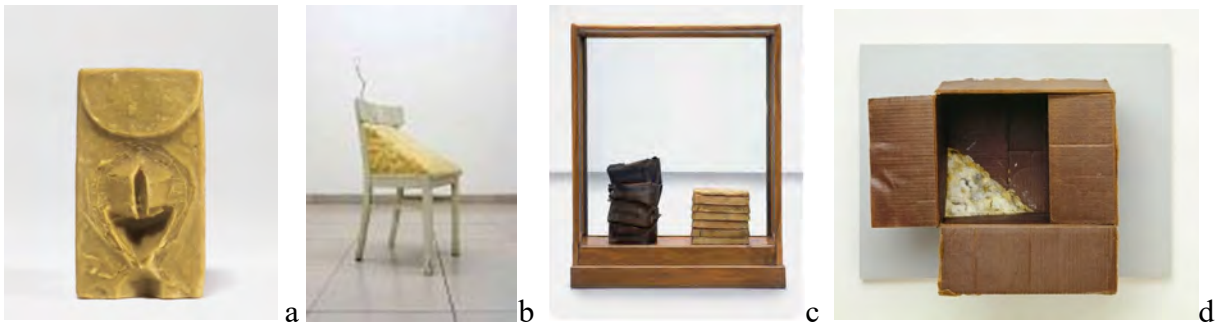

Fig. 5. Joseph Beuys, Conceptual Art, soluble and hygroscopic materials: a - Cuprum 0.3% unguentum metallicum praeparatum, Cast beeswax multiple with finely distributed copper, 1978-86. (19.8 x 10.8 x 10.5 cm), [46]; b- Fettstuhl, installation, object: objet trouve, wax, fat, wire, wooden chair, 1964. (94.5 x 41.6 cm), [47] ; c- Butter and Beeswax, 1975.[48]; d- Fettecke in Kartonschachtel (Corner of Fat in a Cardboard Box), 1963, c/o Pictoright Amsterdam/Stedelijk Museum Amsterdam [49].

Material constellation (Smart materials and materials applied in artwork), is under constant contextual pressure of the symbolic network. In order to be considered in their multitude, many different combinations of possible relations between materials, very important is the integration of artificial intelligence in the actantial analysis, in order to establish a relationship that gives the possibility to materials for Solar Thermal Energy Systems to incorporate in the total constellation, [50].

Heritological connection with the said problem, we find in the *Disertatio de Arte Combinatoria* of 1666, by Gottfried Leibniz, as well as in the Universal Synthesis and Analysis of 1683, by this author [51]. Leibniz presents us with a logic that has an analytical aspect (*Ars Inveniendi*) and the synthetic aspect (*Ars Demonstrandi*), where *Ars Combinatoria* is a mirror of his logical thinking. History of science records and Leibniz's reflection of space: "As for my own opinion, I have said more than once, that I hold space to be something merely relative, as time is, that I hold it to be an order of coexistences, as time is an order of successions", [52].

Bearing in mind that modern science gave a mathematics research [53], as well as modern views of Ars combinatoria in didactics [54], as well as the illustration of architectural forms of spatial syntax theory [55], we tried to involve in this research in the actantial analysis and the relationship between art and philosophy to formalized languages and according to appropriate technical-technological problems.

Compared to the models of the semiotic square showed in Figure 4. (Greimas / Hébert), we searched for a solution that includes ideas of both concepts, with a special focus on Metathermins. Due to the limitations in space, we only show here our parameterization: extraction from combitions (opposite), formal systems (contradiction) and bifurcation (implication), observed from the aspect of philosophy of mathematics, art and general philosophy, in the deliberation of the context of the gallery space for functionalization of smart materials and renewable energy sources, (Fig. 6).

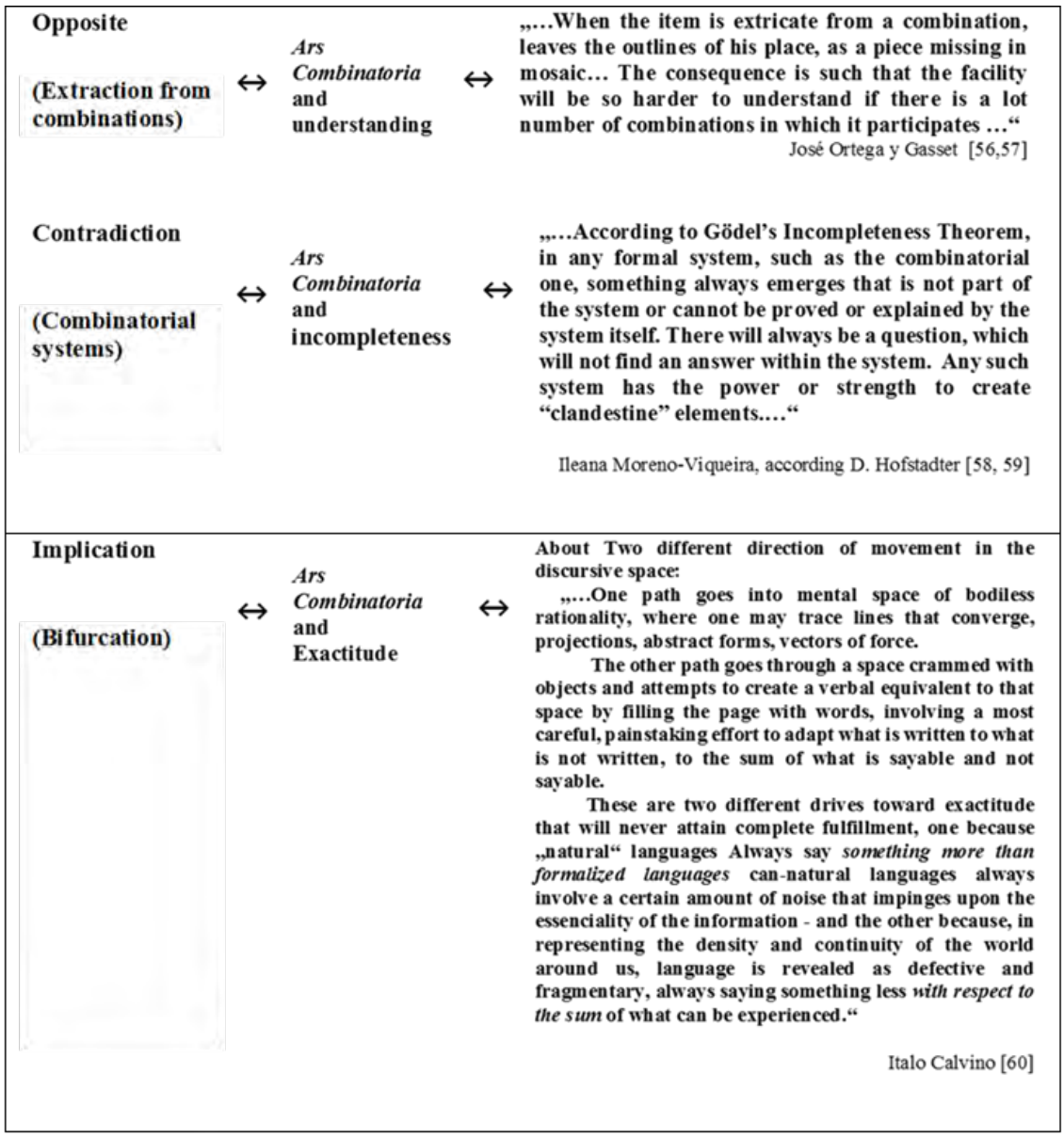

Fig. 6: One possible pattern in a proposal research for semiotic square: metaterms (compound terms)

4 Discussion

One of the possible heritologicaly shaped contexts from the gallery space should come from the choice of multiple parameters, the most complex of which is metaterm. Table 1 shows a choice that had to contain a example of good generalization in connection with the context that can connect the technical - technological formal language and artistical - philosophical understanding through generalization. Therefore, Gödel's theorem of incompleteness was in the focus, that is, its generalization, which performs this mathematical theorem outside from the formal language of mathematics, and through the term a combination system, allows *Ars Combinatoria* to be reached in the description of incompleteness.

Also, with the involvement of art look in the problem of metaphor, the combinatorics were performed outside the formal language, which made it possible to introduce the term of the *extraction from the combination* and the using *Ars Combinatoria* in the descriptive of *understanding*. These two procedures have allowed in the using artistic language to be defining problem of exactitude as an implication that introduces us to the problem of *bifurcation* in the relations of formal and natural languages. In this way, a field of metaterms and the descriptive of context was created as a theoretical insufficiency, which was on the focus of this research on the *Ars Inveniendi - Ars Combinatoria* line.

The heritological angle of observation, in this study, enabled the time as a significant parameter to cover the period from Leibniz's "Possible World", to the contemporary moment, and accent that expressive powers over possible spaces (gallery and complementary spaces) for intention to preserving cultural heritage in what a significant role today and in the future should have smart materials and renewable energy sources.

5 Conclusions

The research shown in this paper was aimed at contributing to the unraveling of the phenomenon of the descriptions of the context of the functionalization of smart materials and renewable energy sources in the art or museum galleries, in the heritological domain.

Research was relied on the understanding of *Ars Combinatoria* through time, in science, art and philosophy, And as an optimal methodological model in this complex area, which multidisciplinary includes different fields of technical and technological and artistic action, It has shown useful structural semiotics, ie the *actancial analysis*, as a method that can help in a better perception of possible links in systemic various areas of theoretical and practical work.

The exploration of the basic character is presented and should serve future research, which will have a narrower problem-orientation for the case studies, for the development of new, more effective approaches of the field of smart material functionality and renewable energy sources in gallery spaces, In the time of the intensive development of smart buildings and cities, the applications of more perfect smart materials and artificial intelligence and consequently, artistic responses to the rise of modern technologies.

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