



DECISION-MAKING FOR THE CONSERVATION AND PRESENTATION OF THE ARCHITECTURAL INTEGRATION *CANOPUS* (1965) BY VICTOR VASARELY

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Introduction

The Hungarian French artist Victor Vasarely (1906–1997) who played a pioneering role in the Op Art movement, created the monumental wall painting *Canopus* for the auditorium of the Pedagogical College in Essen, Germany, in 1965. *Canopus*, an optical illusion with a composition of mainly black and white circles and geometrical fields realised as an architectural integration of c. 400 × 700 cm, is a masterpiece from one of Vasarely's most important artistic periods. Extensively overpainted by a local street-art artist in 2013 and lacking its original architectural context since 2014 the conservation and future presentation of *Canopus* entails a complex decision-making process formed by a variety of different stakeholders as well as a colourful biography of the artwork. This paper analyses both the decision-making and the stakeholder's impact on the process, while taking the revised *Decision-Making Model for Contemporary Art Conservation and Presentation* (CICS 2019) into consideration. Options included in the process of discourse were:

- 1) to remove the overpaint and to represent *Canopus* in a new architectural setting
- 2) to recreate the conceptual artwork either on top of the overpainted original or in a new place while storing Vasarely's overpainted and detached wall painting,
- 3) to conserve the artwork with the overpaint next to documentation of the artwork's biography or
- 4) to consider treating the severely damaged iconic artwork as a total loss as it now lacks its original architectural context.

This reflection is part of a CICS research initiative in which the *Decision-Making Model* is applied to different case studies, aiming to test and verify the model's applicability, to identify blank spots and to consider them in the model. The project is generously funded by the Wüstenrot Stiftung.

Step 1: Point of Departure

Circumstances

The subject of this case study is the monumental architectural integration¹ *Canopus* by Victor Vasarely, which he created in 1965 for the entrance hall of the auditorium of the Pedagogical College in Essen (Spies 1971, p. 176). Prior to the demolition of the campus in 2016 the Department for Building and Real Estate Management NRW (BLB NRW) decided to remove the important artwork – a piece of public property – from its original architectural setting. This aim was pursued even after the artwork had been extensively overpainted by the local street artist Victor Szabo and damaged by vandalism (Brakebusch 2016). In 2016, the point of departure of this decision-making process, *Canopus* had been stored in the Brakebusch conservation studio for more than a year, awaiting an agreement on a further plan of action.

At the time Börries Brakebusch contacted Gunnar Heydenreich at the Cologne Institute of Conservation Sciences (CICS). Together they initiated a project that was pursued by Julia Hartmann as a master thesis and was set to run for two years. This research period was supported by the BLB NRW in anticipation of the development – and if possible, also the implementation – of a professional conservation strategy that would serve to present *Canopus* adequately in the future. At this point, the lack of knowledge about the chemical and physical interaction between Szabo's spray-paint and the paint layers of *Canopus* impeded the preservation of the artwork. Therefore, the thesis included a feasibility study addressing the removal of the overpaint. The urgency of this study was increased because the BLB NRW had already begun to consider it impossible to remove the overpaint, which put the preservation of the artwork at risk.²

Initial aim

In 2016 the BLB NRW and CICS agreed upon the initial aim of the long-term preservation of *Canopus*, including its reinstallation in a new architectural context.³ Whereas the BLB NRW wished to re-establish the painting's condition from the period before the interventions by Szabo and others in 2013, CICS strove to first examine the work and develop a conservation and presentation strategy in accordance with the research results. The master's project thus posed an opportunity to undertake a feasibility study for the removal of the overpaint, to evaluate other conservation strategies and to assess the artistic value of Szabo's intervention, taking conservation ethics into account.

Stakeholders

As a public artwork the decision regarding *Canopus'* future involved a variety of stakeholders, ranging from the actual-decisive, relevant decision-makers to more basic stakeholders, who – although not taking the decision themselves – play an important role in the process and may significantly influence the decision. In the following the most relevant stakeholders will be described considering their main interests, aims and relationships to *Canopus*, including their legal power and moral obligations. More stakeholders with different backgrounds and interests were involved and interviewed during the project to gain additional information and to consider guiding perspectives concerning the ethics of this conservation challenge.⁴

The Bau- und Liegenschaftsbetrieb Nordrhein-Westfalen (BLB NRW), Department for Building and Real Estate Management of North Rhine-Westphalia, legally represents the owner of *Canopus*, the state of North Rhine-Westphalia. The BLB NRW employs experts among others in architecture, management and finances, but does not have a specialized department for conservation, art handling or art history. It is the real estate service provider and sales manager that acts on North Rhine-Westphalia's behalf to purchase property and control its daily use. It operates according to economic criteria and is subject to the official and technical supervision of the state's Ministry of Finance.⁵ For the BLB NRW the preservation of the artistic and cultural values of Vasarely's *Canopus* is at the core of its interests.⁶ The responsibility to preserve and protect *Canopus* was first agreed upon orally in 2004⁷, signed in a self-declaration in 2007⁸ and renewed in a formal letter of cooperation between the BLB NRW and the Fondation Vasarely in 2019.⁹ The BLB NRW acknowledges that *Canopus* is not presentable in its current state and has considered storage of the painting until a conservation strategy is agreed upon and funding is granted.¹⁰ The aim of the BLB NRW to conserve and present *Canopus* reflects its moral responsibility and may enhance its reputation. The BLB NRW is the decisive decision-maker in this process.

Cologne Institute of Conservation Sciences (CICS) with Gunnar Heydenreich as project coordinator and Julia Hartmann as master's student took on the project as it offered an attractive research topic, a conservation challenge, and an opportunity to raise public awareness about CICS. The case study continues the CICS initiative to develop conservation strategies for public artworks, *Kunst am Bau* (Heydenreich 2012). A signed co-operation agreement put CICS in the position of partner to advise the BLB NRW with regard to a conservation and presentation strategy and the possible risks involved when removing the overpaint. Thus, CICS is considered an expert adviser and holds a veto right concerning the future presentation of *Canopus*.

The Fondation Vasarely, Aix-en-Provence, France, supports research on artworks by Victor Vasarely and provides advice regarding their conservation. Its president, Pierre Vasarely, is the universal legatee, and holder of the moral rights for the artworks by his grandfather Victor Vasarely. Pierre Vasarely's main interest is the conservation and presentation of *Canopus* in a new architectural context, for which a late involvement in the project and faults in protocol were accepted.¹¹ The

Fondation Vasarely relates to the BLB NRW by the laws of the artists copyright as well as in moral terms. A formal letter of support between both institutions was signed in 2019.¹²

The conservators Kristina and BÖrries Brakebusch were commissioned to remove *Canopus* from its original setting in 2013. At the point of departure of this study BÖrries Brakebusch had invested a considerable effort in the preservation of *Canopus* and he had also published a text on the ethical aspects of the artwork that had lost its architectural context (Brakebusch 2016). Brakebusch demonstrated that he valued the art historical and public importance of the architectural integration and felt morally responsible to preserve it for future generations, which is why he contacted CICS to launch a student research project. BÖrries Brakebusch is considered an expert adviser.

The Landschaftsverband Rheinland (LVR) – Amt für Denkmalpflege im Rheinland, Office for the Preservation of Historic Monuments cares for the region's cultural heritage for the State of North Rhine-Westphalia. In 2007 experts from the LVR's department of wall paintings and polychrome architecture evaluated the historical value and the condition of *Canopus*. The assessment prompted an official commitment from the BLB NRW to preserve the artwork. Although, neither the Pedagogical College in Essen nor *Canopus* had been listed as a cultural heritage monument, the LVR prepared the ground for *Canopus'* preservation. At the beginning of this project the LVR offered its studio to conduct the research project, hoping to exchange views and support the field of conservation of contemporary artworks and modern materials. LVR is to be considered an expert adviser.

Victor Szabo is a street-art and graffiti artist most prolific in the Ruhr area. Here he may be considered as a stakeholder with a personal interest in the case, even though he hides his identity. According to an interview-based article the artist has worked under different pseudonyms in the past, but 'Victor Szabo' was the one he used most (Emonds et al. 2011). Szabo took part in several street art exhibitions and workshops.¹³ He is known and respected in the street art scene but chose not to operate under the pseudonym Szabo after 2015.¹⁴ By changing the visual appearance of *Canopus*, he intervened illegally and as such this overpainting may be considered as crime¹⁵ and as violation of the artistic copyright held by Pierre Vasarely. Although as a stakeholder Szabo is not decisive for the decision regarding *Canopus'* conservation, as an artist he holds the copyright for his own creation and could increase his impact accordingly by claiming his rights and / or mobilising the public if his artwork was to be altered.

The public: during the evaluation interest was expressed by numerous individuals, private groups and local authorities, in particular the city of Essen, but also former students who feel related to the original location of *Canopus* as well as artists and members of Essen's Street art community.¹⁶ The public has no direct vote in the present decision-making process, but *Canopus'* status as a public artwork means it could be granted more authority at any time.

Mode of Decision

While analysing the stakeholders and their potential for the decision-making process, their power, interests, aims, administrative and expertise-based connections, as well as the conflict potentials are considered. The BLB NRW ought to hold the active power in the decision-making process, but it is also bound by legal rights and administrative processes as well as the hierarchical supervision by the Ministry of Finances and the cooperation with the Ministry of Culture and Science. The BLB NRW is responsible for the public artwork, but its decisions are guided by advice from the LVR as well as from external conservation experts. The obligations of the BLB NRW therefore determine the underlying framework regarding legal and moral responsibilities in this decision-making process. Morally,

and legally, since the signing of the contract in 2007, the BLB NRW is responsible for the preservation of the publicly financed artwork.¹⁷

In the case of *Canopus* the German copyright law (Urheberrechtsgesetz) applies, according to which Pierre Vasarely represents his grandfather Victor Vasarely.¹⁸ Thus, Pierre Vasarely and the Fondation Vasarely are a moral instance in the decision-making with regard to the conservation and presentation. They cannot intervene in the different conservation proposals, but if the artwork is later displayed in public, legal rights arising from the copyright ownership take effect. Pierre Vasarely owns the right to prohibit inappropriate presentation strategies, as well as any altering changes to the original artwork, in order to protect the artist's intention and the artistic idea.

CICS' role is to research the artwork's biography, to conduct scientific analysis and to appraise *Canopus'* current condition in order to develop and evaluate various conservation options within the context of a thorough feasibility study. Brakebusch, CICS and the LVR form a stakeholder group that provides advice concerning the associated possibilities and risks of these options for conservation and presentation. This group of stakeholders has a strong professional obligation and ethical ambitions to preserve artworks, however, their power in the decision making is mainly moral. Regarding the future architectural setting for *Canopus* the BLB NRW and CICS agreed that CICS could suggest a new location and reject other proposals (veto right). It will therefore be authorized to actively participate in this second decision.

In 2004 the LVR laid the foundations for the preservation of *Canopus* with an evaluation of the artworks' significance, followed by an initial estimate of the possibility, in conservation terms, to preserve and remove *Canopus* from its architectural context.¹⁹ LVR actively supports professional conservation, but it gained no legal rights to intervene in the decision making.

Although considered a stakeholder, Victor Szabo is not actively involved in the decision-making. In legal terms he could claim the copyright for his creation, but he could not intervene in the removal of the overpaint and the ensuing destruction of his artwork. Nevertheless, a public presentation of his work in a new location would require his approval.

In addition to the stakeholders who are actively involved in the decision process regarding the conservation, other interest groups might gain a greater influence regarding *Canopus'* future presentation.

In conclusion the decision mode concerning the preservation of *Canopus* can therefore be described as an individual decision by the BLB NRW who represents the public ownership of the artwork. The BLB NRW is bound in its decisions to a legal framework, including financial constraints and will take the scientific and other professional advice into account. In the case at hand the BLB NRW actively searched for advice by the stakeholders. Decisions by consensus were reached within the meetings. The role and the power of the stakeholders may change in the future with new tasks and associated new decisions.

Step 2: Data-generation and registration

The following two steps aim to describe *Canopus*, its history and art historical context, the painting techniques and materials, as well as its current state and significant alterations.²⁰

Object Description and History

The monumental, large-scale wall painting *Canopus* originally measured approximately 400 × 700 cm and consists of black, white, and blue monochrome colour fields.²¹ Framed by the architecture of the staircases in the foyer Vasarely created geometrical shapes that led to an optical illusion of space and movement. Developed as a *Kunst am Bau* project it is assumed that Vasarely's proposition of *Canopus* was awarded on the basis of a public tender, which was the normal procedure at the time.²² Following his self-image as a 'plastic artist'²³ and his documentation of other public artworks, Vasarely probably planned *Canopus* as a graphic miniature drawing permutating from earlier artworks and gave explicit instructions concerning the materials and techniques to be used. He presumably had the final mural painted by assistants or a local company but supervised the process and personally signed the work in 1965.

Shortly after the wall painting was first executed in 1965 cracks seem to have appeared in the concrete wall. This unintentional structural damage may have been the reason why *Canopus* was completely re-created some time before 1975.²⁴ There is no archival evidence to indicate whether Vasarely himself, an assistant or a local company executed the identical repainting. *Canopus* was signed a second time and Vasarely authenticated the newer version when he included two photographs with the second signature in his permanent exhibition in 1976 (Fig. 1). The Fondation Vasarely confirmed the attribution of *Canopus* in its state from 2013 to Victor Vasarely's body of work.²⁵ *Canopus* is considered a masterpiece by Vasarely (Vasarely, Joray 1979).

In 2005 the Pedagogical College was affiliated to the University of Essen and the former campus building was abandoned. Several plans for renovation, alteration or reuse were considered but not implemented until the building was vandalised in 2014, cleared and sold in 2015 and finally demolished in 2016.

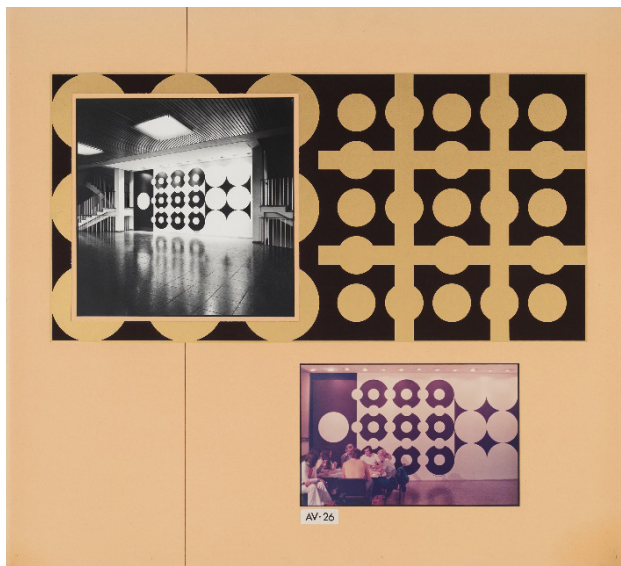


Fig. 1: Victor Vasarely, Présentoir-study AV 26, 1975, Fondation Vasarely. Photo: Fondation Vasarely/Fabrice Lepeltier, 2021.

The 'présentoirs' are mechanised vitrines that show examples, of the creative process, the so-called 'études' of Vasarely's art. All 'études' have standardized formats on cardboard. This study AV 26 (Number 26 of Présentoir A, verso) shows two photographs of *Canopus* in Essen and a silk-screen print (black ink on gold) with the same title *Canopus*. This 'étude' was first exhibited in the "présentoir A Verso" in Vasarely's Centre architectonique in Aix-en-Provence in 1976.

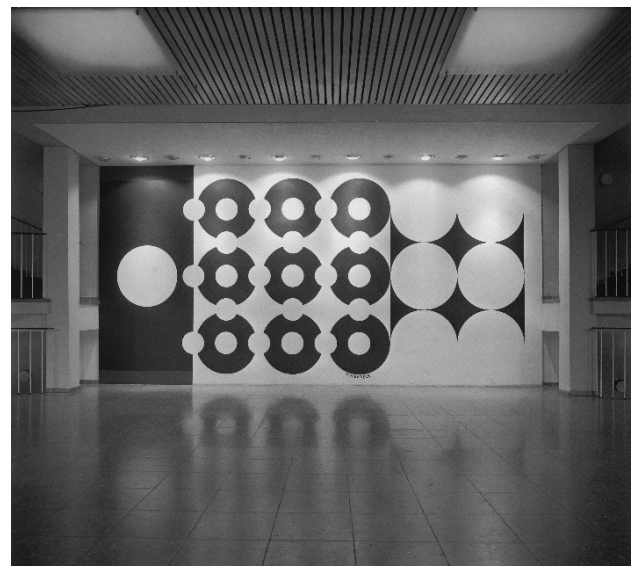


Fig. 2: Victor Vasarely, *Canopus*, 1965, auditorium of the Pedagogical College in Essen, Germany. Photo: Werner Hannappel, 1975.

After discussions between different departments of the BLB NRW, the LVR and other cultural heritage institutions²⁶, the proposal to put *Canopus* on the official cultural heritage list was finally rejected in 2007. Instead, an agreement for the preservation was negotiated, which considered a professional detachment, storage and reinstallation of the artwork in a new location.²⁷ In 2014 the conservation studio Brakebusch in Düsseldorf was commissioned to detach the painting from the wall. However, before this could be done, the street art artist Victor Szabo had overpainted almost half of *Canopus*' surface with alkyd-based spray paints (Fig. 3). He developed his own motif on top of the existing mural, thereby partly integrating Vasarely's composition. Thus, Szabo created a new artwork as a synthesis of both artistic ideas. Subsequently, the wall painting also suffered from vandalism, including scribbles with a black felt tip marker as well as smears of organic matter.

As the detachment of *Canopus* had already been scheduled the conservation studio went ahead and removed the dirt and separated the painting from the wall. A polyester fabric, originally embedded in the ground layers, facilitated the removal and handling of the work. The painting was rolled up and stored temporarily.²⁸

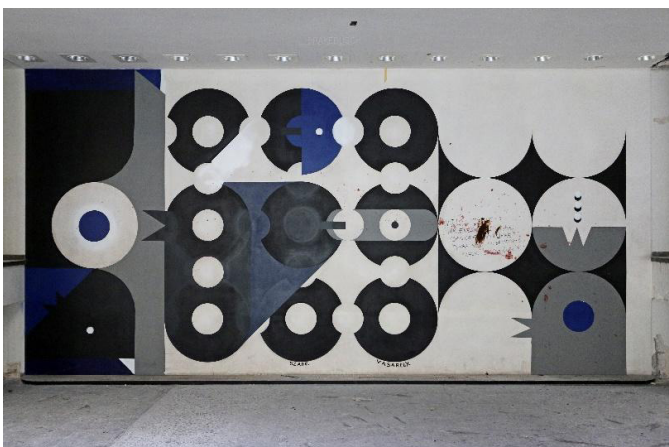


Fig. 3: *Canopus* in 2015 after the intervention by Szabo and the subsequent addition of scribbles and smears. (Photo: Brakebusch 2014)

Materials and technique

Canopus was executed on white preparatory layers which completely covered the approximately 4 x 7-meter concrete wall. There is a polyester fabric embedded in the polymer-based elastic ground layers, possibly to cover cracks in the wall. After this careful preparation, geometrical forms were drawn and probably masked,²⁹ before white house paint was applied in comparatively thick layers with a paint roll, leaving a characteristic surface texture. FTIR analysis confirmed the presence of acrylic binders. Subsequently, black forms were painted in thin layers with a polyvinyl-acetate-based paint (FTIR) and brushes, leaving brush-strokes visible on the surface. Finally, brilliant dark blue paint was applied in the two smaller areas. The blue surface is very sleek and it was possible to identify drying oil, synthetic binding media and ultramarine pigment (FTIR) in this blue paint.

Step 3: Current State (Condition)

Canopus' current state is characterised by the loss of its architectural context, Szabo's large overpaints, smears and scribbles as well as minor signs of ageing and degradation. The loss of the architectural synthesis leaves *Canopus* as a fragment. Largely overpainted passages interrupt the original composition and create a new motif with abstract birds (Fig. 3). Together with the smears

and scribbles these interventions impact the experience of Vasarely's artwork with its black and white contrasts and optical illusions.

Szabo worked with spray paints using several application techniques. Following careful preparation with pencil drawings and a deliberate use of tape, he applied the paints in five different colours in single and multiple layers with sharp and diffuse transitions. FTIR analysis confirmed the presence of an alkyd binder and cellulose-nitrate components in all the spray paint colours used by Szabo.³⁰ Alkyd-medium serves as the main binder and it adheres well to the acrylic and polyvinyl-acetate based paint layers of *Canopus*. Furthermore, the solvent-based application and penetration of these solvents into the original paint layers led to a stronger bond, especially in the black and dark blue passages. Here the solvents partially redissolved the acrylic and polyvinyl-acetate based paint layers and promoted a physico-chemical bonding. Furthermore, the smears and felt-tip scribbles caused disintegration and may support structural degradation of the paint layers in the affected areas.³¹ Since all of these later additions provide multiple risks for *Canopus'* paint layers such as stronger bonding, crack formation and degradation, a removal of the overpaint is considered an appropriate measure.

Furthermore, there are typical signs of ageing and degradation in the original paint layers of *Canopus* such as dirt accumulation over time, craquelures, and yellowing, as well as minor damage such as abrasion, scratches and stains, especially in the lower area. These may be explained by the highly frequented public exhibition space and the fact that for over 20 years students not only passed by, but probably also touched the artwork.

Step 4: Desired State (Meaning)

To grasp the artwork's identity, its significant properties and the states in which the artwork is considered as authentic were analysed. Determining which properties are constitutive is a subjective assessment that may depend on different factors, such as the interpreters professional background and interest, the level of knowledge about the artwork and its biography, and the prevailing *Zeitgeist*. Vasarely's composition *Canopus* is generally recognized for its sharp contrasts of abstract non-figurative geometrical fields that create an optical illusion of space and movement. Created as a so-called architectural integration it is also characterized by its location and synthesis with the architectural context.

Vasarely created *Canopus* as the first public large-scale architectural integration in Germany. With its composition of mainly black and white optical illusions of circles and geometrical forms, *Canopus* belongs to the 'Black and White' period (1951-63)³². This period is considered to be the most important phase in Vasarely's artistic career towards the development of Op Art, an art genre that creates subjective optical illusions of motion and space - and a precursor of the kinetic art movement (Hasler 2019). With his professional background as a graphic designer and his deep interest in the German Bauhaus, Vasarely's art theory followed several objectives, including the intention to create social art that is present in daily life, that colours cities and that is universally understandable and available to all. Vasarely aimed to achieve this idealistic approach by the realisation of an ideal symbiosis of art and architecture.³³

Vasarely planned *Canopus* for the most frequented hall of an educational institution where it was part of the students' everyday life. The motif basically consists of prototypes which Vasarely used in several other instances, dimensions, permutations and materials. None of the compositions match exactly, but the familiarity between *Canopus* and many other integrations, paintings, graphics, silk-screen prints and even sculptures is obvious.³⁴

In comparison with his fellow kinetic artists³⁵, Vasarely's artworks for the exhibition 'Le Mouvement, galerie Denise René, Paris, 1955' were not based on mechanical movement, but rather on the movement of the recipient and the didactic process during the reception (Schröder 1992). Vasarely considered therefore probably the changing perspectives of the recipients moving in the auditorium of the Pedagogical College in Essen. By walking up and down the stairs in front of and next to the integration, or by approaching and leaving *Canopus* the illusion of space and motion is perceived differently and depends on the movement of the visitor (Spies 1971, p. 79).

Vasarely was conscious of the materials that he used for his artworks. He carefully considered their ageing behaviour and he always aimed for high quality products with long durability.³⁶ Vasarely worked very precisely and he accurately defined surface appearances as brilliant or matt, even or structured, opaque or translucent. Nevertheless, he also liked to experiment with new materials and was therefore sometimes confronted with unexpected changes in appearance.³⁷ Vasarely usually accepted these changes unless the legibility of the motif was affected, which was presumably also the reason for repainting *Canopus* after cracks in the wall disturbed the composition.

In summary, the stakeholders agree that *Canopus*' significant properties are a precisely executed, highly contrasted and immediately comprehensible composition with optical illusions of space and movement, presented indoors in a public architectural space that allows the visitor to experience different perspectives controlled by their own movement. Although Vasarely often delegated the working process to assistants and may be conceived as a precursor of conceptual art, he also pursued a concept of uniqueness by signing his works including *Canopus*.

Step 5: Discrepancy

Considering the artwork's current and desired states, the stakeholders confirmed a considerable discrepancy due to the loss of both the architectural context and the legibility of Vasarely's composition. *Canopus* is a fragment because the surrounding architecture is missing. Vasarely aimed to integrate his artwork into human daily life, especially of the students. Without the architectural context the artwork cannot be experienced from multiple perspectives nor is it present in the daily public life. According to the actively involved stakeholders, traces of use, ageing and decay that occurred before 2013 can be considered as minor aspects of discrepancy from the apparent perfect finish of the original, because the reception of *Canopus* is not significantly affected. In its current state neither dust accumulation and yellowing nor minor scratches and abrasion of the original paint layers disturb the perception of the monumental artwork significantly, which requires a viewing distance of at least several meters.

Although the possibility of touching the artwork in a public space might have been considered and accepted by Vasarely, he did not accept all changes caused by use and degradation. When the first realization of *Canopus* was affected by the wall's structural problems he seems to have agreed to a recreation instead of repair. This aspect and Vasarely's expressed desire for durability need further consideration when developing options for the conservation and presentation of *Canopus*.

Szabo's overpaint covers most of the surface and creates a completely new visual experience for recipients. In particular the black and white contrasts of the purely geometrical fields were lost beneath the overpaint in five different colours and a motif that shows abstract birds. Therefore the optical illusion of forms and their movement is lost (compare Fig. 1 and Fig. 3). Furthermore, the relief surface structure and matt finish was also affected by the thick and more glossy finish of the alkyd paints. Thus, the overpaint has a significant impact on the desired state of *Canopus*. Apart from the optical alteration, the physico-chemical bonding between the poly-vinyl alkyd based overpaint and

Vasarely's acrylic paint can be considered as structural damage, which might increase over time. Subsequently applied scribbles and reddish stains on the painting add to the visual impact on the original motif that has been interpreted by the stakeholders as disturbing, because it interferes with the illusion of space and movement.

Step 6: Conservation/Presentation Options

As part of this research the initial aim was expanded, and alternative strategies were considered. The following options were suggested with the objective to reduce the discrepancy between the current and the desired state and to develop the most appropriate strategy for the long-term conservation of *Canopus* and its future presentation in a new architectural setting:

1. Removal of Szabo's intervention and presentation of the artwork in a new architectural location.
2. Recreation of *Canopus* by either
 - a) overpainting Szabo's additions to recreate the original motif and presentation of the work in a new location, or by
 - b) recreating Vasarely's integration in a new location, while preserving *Canopus* in its current state.
3. Preservation of Szabo's motif by displaying the painting in its current condition alongside a documentation of the artwork's history.
4. Retirement of the work because the architectural context is now lost and its aesthetic appearance compromised by graffiti overpaints. This concept would lead to a long term-storage of the fragment or more drastically the destruction of *Canopus*. However, this option would not serve the aim to reduce the discrepancy between the current and the desired state.

When developing presentation options, new architectural settings need to be considered and explored that correspond to the artist's intention to create a social artwork. For the synthesis of the painting and its surrounding space the artwork should be permanently attached to a wall.

Step 7: Considerations

1. Removal of Szabo's intervention and presentation in a new location

The feasibility study conducted by CICS with regard to the initial aim (to re-establish *Canopus*' condition from the period before Szabo's interventions) showed that it is generally possible to remove the overpaint, although both complicated and risky. While the spray paints show a limited solubility in a small number of solvents, their solubility parameters appear to be very similar to the ones of the paints used for *Canopus*. Furthermore, the ageing properties of each of Szabo's and Vasarely's paints differ, depending on their colour and thickness. Each different layer structure therefore requires a local treatment that takes different cleaning systems such as mechanical as well as solvent-based approaches into account (Hartmann 2018, p. 99-101, 110-112). Removal of the overpaint requires constant checking and adaption of the strategy according to the prevailing layer structure and the solubility characteristics. There is a risk of damaging the original surface structure as well as altering the colour and appearance of the original paint layer because of microscopic spray paint remnants. This suggests that the treatment will be very time-consuming, and the related costs are expected to be significantly high. Financial constraints have to be considered, as the

BLB NRW articulated the pre-condition that the costs for the conservation of the artwork should not exceed its monetary value after treatment.

In the case of a removal of the overpaint it is also necessary to evaluate and anticipate the condition that can be achieved, how the aesthetic qualities of *Canopus* can be re-established and at what point, surface damage could result in a new discrepancy between the then current condition and the desired state. Despite these difficulties and within financial constraints this approach enables to preserve the iconic work by Victor Vasarely. Instead, Szabo's artwork would be destroyed, and the only trace of its existence would be provided by documentation. In this case the artistic value of Vasarely's work would be more highly valued than the history of the work and its changing reception.

2. Recreation of *Canopus*

Another option to re-establish *Canopus*' appearance from before 2013 is to recreate it by either a) overpainting Szabo's interventions or b) creating *Canopus* anew – on a new support in a new location.

Recreation by overpainting Szabo's additions and presentation in a new location

A recreation of Vasarely's *Canopus* on top of Szabo's additions would retain the present layer structure. In this option there are no legal conflicts. The legibility of *Canopus* is re-established, even if the original painting as well as the later additions are covered and therefore no longer visible. However, should the original *Canopus* be revealed at a later point in time, there is a high risk that the bond strength between the original paint layer and Szabo's additions will increase, and that a removal will be more difficult if not impossible.

*Recreation of Vasarely's integration in a new location and preservation of *Canopus* in its current state*

There is also the option to recreate *Canopus* on a new support in a new location. This approach considers the fact that Vasarely did not paint the *Canopus* himself, but commissioned assistants or a professional company with the execution of his concept and that he promoted the production of editions in general. His oeuvre includes countless so-called 'multiples' that he did not necessarily manufacture himself. In his opinion, the artistic idea had to come from him, the creator, while the executional hand became secondary.³⁸ He considered 'prototypes' as 'originals' that communicate the artistic idea. To execute these ideas, he used to assign professional companies or assistants, and to officially legitimate the artwork he signed them himself (Victor Vasarely: 1967. *Les Multiples*. In: Ferrier 1971, p. 167).

Today, *Canopus* could be recreated with materials very close to the original based on results from the scientific analysis of binding media, pigments and fillers as well as the study of archival documentation of paint systems used for other similar integrations. Costs for a recreation would be lower than for a removal of the overpaint. In exceptional cases the recreation of Vasarely's artworks has already been practiced with the permission of Pierre Vasarely. However, this option appears secondary, as Victor Vasarely honoured material and also accepted changes due to degradation as long as the artistic intention remained experienceable.³⁹ The Fondation Vasarely expressed the concern that recreation of *Canopus* may also convey the wrong message, suggesting that it is acceptable to alter or destroy Vasarely's artworks and that the preservation of the original material is not important.⁴⁰ Furthermore, a recreation would lack the artist's signature as well as the aged condition of the original painting, which provides evidence of time and the former installation in the college. By recreating *Canopus*, the conceptual idea and aesthetic appearance would be more highly valued than the material integrity and historicity of both Vasarely's and Szabo's works.

3. Preservation of Szabo's motif by displaying the painting in its current condition alongside a documentation of the artwork's biography

Furthermore, it was considered to preserve Szabo's motif with a documentation of Vasarely's *Canopus* to explain the history of the artwork. This approach would emphasize Szabo's work, the evaluation of its artistic value and the moral obligation for its preservation. It offers the option to resume currently attributed values in the light of future research and new possibilities. While the smearing and felt-tip tagging can be classified as wilful damage to both artworks, the status of the intervention by street artist Szabo is more difficult to interpret with respect to both moral and legal terms.⁴¹ The techniques favoured by Szabo to create the motif show professional experience using methods like stencils, cut-outs, free sprays, and correction sprays. Details mattered so much that minor mistakes were worth retouching. In areas with more yellowed original white paint, Szabo even took the time to retouch some of Vasarely's forms, even where he integrated them completely into the new motif. He meticulously pre-planned and executed the work. He also understood Vasarely's formal elements and adapted to them, to a great extent even following the colour scheme of the original artwork. The artistic motif, technique and materials suggest the artistic intention of integration rather than the aim of destruction, which would have been an indication of vandalism (Demandt 1997, p.19). Nevertheless, in legal terms, Szabo's overpaint is considered property damage and he could have been prosecuted at the time.⁴² In any case, the right to freedom of artistic expression could be raised against the accusation of damage to property which makes it difficult to name precedent cases. Szabo meets Vasarely's requirement that artists should claim public spaces and integrate their art into people's lives. Although artistic and thoughtful, Szabo's intervention affects an interpretation of the intended reception of the artwork in a crucial way. It is no longer possible to experience the illusions created by Vasarely. Vasarely motivated artists to develop their own ideas by using his work as inspiration, but he was very clear about unsanctioned changes to his own compositions and mercilessly persecuted assistants who claimed rights for the production process or changes to his artworks. The stakeholders assume that Vasarely would not have accepted Szabo's new motif.

Szabo's motif can be regarded as a second artwork with its own biography, while *Canopus* at present could be attributed a higher cultural value, in synthesis with Szabo's art. But Szabo does not even promote the durability of his artworks, instead, he stated in 2011, that he knows, accepts and aims for the ephemeral character of his murals.⁴³ Thus, the option to preserve Szabo's motif would keep both artworks and would also offer a re-evaluation of the attributed values in the future, including the possibility of removing the intervention. A prerequisite for this is that the overpaint can be removed in the future, however the physico-chemical bonding between the paint layers is likely to increase.

4. Retirement due to the graffiti overpaint and the missing architectural context

Canopus is a site-specific artwork and as such it heavily depends on the architectural context. Embedded in the central hallway of the highly frequented college building its architectural quality embodies one of the significant properties that are integral to the artwork's identity and authenticity. The remaining fragment could either be documented in its current condition and stored long-term or be cleared for demolition just like its support, the Pedagogical College of Essen. In this case, none of the copyrights, neither that of Vasarely nor Szabo's would be violated. The owner would be spared the costs of research and treatment. However, destruction would mean the loss of an iconic piece of art, the first by Vasarely in Germany, as well as the loss of Szabo's motif.

Long term storage of the work would offer the opportunity to re-evaluate attributed values in the future and to develop new technologies for the removal of the alkyd paints. Nevertheless, storage of this work in a non-museum environment would include a considerable risk of complete loss over time. As the BLB NRW already followed the advice of the LVR in 2007 and accepted responsibility

to preserve *Canopus* for future generations this option does not correspond to the overarching goal of the project.

The stakeholders rated the proposed options differently in the overall importance, taking various assessment criteria into account such as the artistic, aesthetic, and iconic value of the artwork, its authenticity and historicity, conservation ethics, administrative needs (financial and legal concerns), technical restraints (difficulties and limitations) as well as the monetary and educational value of the artwork. To visualise the ratings by various stakeholders, a flower- and a spider chart (Fig. 4 and Fig. 5) were generated.⁴⁴ Both plots provide information on the stakeholders' average assessment of all criteria. While the flower chart additionally provides information on the aggregation of all considerations (represented by flowers' height), the spider chart provides comparatively more detail on individual options as it includes information on the variation between stakeholders (see footnote 44 for details). Generally, Option 1 is rated higher than all other options. Although the removal of Szabo's intervention and the presentation of *Canopus* in a new location involves technical and financial challenges, various stakeholders consider Option 1 as a feasible way to preserve the authenticity and historicity of *Canopus* and to maintain its art historical, monetary and educational value, while complying with conservation ethics. In Option 2 to 4, the financial and technical restraints seem negligible, but other central values are contemplated to a lesser extent than in Option 1, e.g., the artwork's authenticity and historicity, its aesthetic, artistic, iconic value, its potential regarding educational research and prevalent conservation ethics.

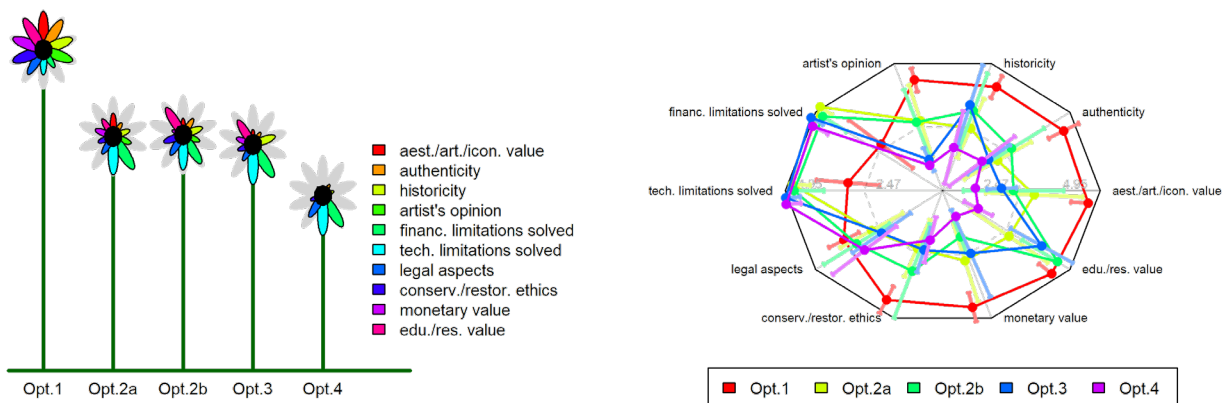


Fig. 4 and 5: Considerations visualized using flower- and spider-plots based on ratings by multiple stakeholders in the case at hand.

Option 1: Removal of the overpaint, Option 2a: Recreating *Canopus* by overpainting Szabo's additions, Option 2b: Recreating *Canopus* in a new location, Option 3: Preserving Szabo's motif by displaying the painting in its current condition alongside a documentation of the artwork's biography, Option 4: Retirement due to the graffiti overpaint and the loss of the architectural context.

Step 8: Conservation Strategy

Based on the joint evaluation of the different options, the feasibility study which proved that a removal of Szabo's overpaints is possible (Hartmann 2018, pp. 110–112), and the expert stakeholder advice, the BLB NRW decided to remove Szabo's overpaint, to reinstate *Canopus'* appearance from before the interventions of 2013 and 2014 and to prepare a reinstallation of the wall painting in a new carefully chosen architectural setting.

In order to implement the strategy and to commission the treatment, the BLB NRW requested to establish the monetary value of *Canopus* after its conservation for which an independent assessment was commissioned. The result of this evaluation could have challenged or even re-directed the final decision, but this was not the case.

The removal of Szabo's intervention will consider 13 zones that differ from one another regarding their material composition, layer sequence, surface structure, and the varying physico-chemical bonding between the layers. Although potential mechanical abrasion, deriving from the separation process, may put the integrity of the surface structure at risk, this is outweighed by the chance to preserve the intrinsic value of Vasarely's authentic integration. The decision to remove Szabo's overpaint was corroborated by the fact that the bonding between the layers is likely to become stronger over time.

Although within the feasibility study, possibilities and risks of a potential removal were thoroughly explored, the repercussions on *Canopus* will only become fully apparent during the implementation of the strategy. Should unexpected difficulties arise and the risks for *Canopus* prove higher than initially anticipated, the chosen strategy might need to be further adapted. In the case of the latter, decision-makers will have to go back (to step 6) and elaborate other options to conserve and present *Canopus*.

Szabo's overpaint is still considered as a second artwork and not as a product of vandalism. According to Szabo's published statements and his intervention at a time when the building was officially inaccessible and about to be demolished, his painting is conceived as a temporary artwork, a concept which was not conceived by Vasarely. Considering Szabo's artwork against the backdrop of current conservation ethics and comparing the two artworks in the context of artistic value and today's perception, the importance of Vasarely's *Canopus* outweighs that of Szabo's artwork both in legal and ethical terms. The installation of *Canopus* in a new architectural setting needs to be explored by the stakeholders and would also require approval from the Fondation Vasarely. In summary, the decision fits the aim that was expressed at the beginning and later reaffirmed to reveal *Canopus* and to reintegrate the painting in a new architectural setting. It corresponds to the interests of the most powerful decision-maker and owner of the artwork, the BLB NRW, and follows the advice of the LVR, CICS and the Fondation Vasarely.

Conclusion and Perspectives

The decision-making regarding *Canopus'* conservation and future presentation developed as a complex and long-drawn-out process. The large scale of *Canopus*, the total loss of its original context, the glaring discrepancy between the painting's current and desired state, as well as the evaluation of Szabo's artwork challenged the decision for the conservation and future presentation and requested a consideration of legal, ethical, technical, and financial aspects. Though the case was opened by an initial aim and overarching goal that was common to all stakeholders, the process turned out to be a balancing act shaped by the different ethical and professional backgrounds and the corresponding expectations in the case at hand. To navigate through this process the *Decision-Making Model for Conservation and Presentation of Contemporary Art* proved helpful in structuring, analysing and reflecting the stakeholders' roles whose involvement and power changed depending on the chosen strategy. In the first step - the *Point of Departure* - the model introduced these differing interests, roles and influences, and contextualized the further process.

As for *Canopus*, the decision-making process didn't follow a straight line. It was rather complex and required a dynamic approach. On several occasions it was necessary to return to earlier stages of the process as new stakeholders arrived on the scene. For example, the Fondation Vasarely initially joined the group of stakeholders as a passive observer, but gained more influence when discussing possibilities for a recreation of *Canopus* as well as the options for its future presentation. A juridical tie increased the stake of the Fondation Vasarely. Ethical considerations were stimulated by stakeholders' advice. Financial aspects challenged and delayed the process, while unexpected

occurrences, such as for example the interest shown by North Rhine-Westphalia's Minister for Culture, Isabel Pfeiffer-Poensgen, whose visit in 2019 boosted the motivation but also the obligation of all stakeholders. A public debate to discuss the decision has not yet been initiated. At this point the BLB NRW is setting up the administrative process for commissioning conservators to implement the elaborated strategy. Options are currently being explored in the search for a new, appropriate architectural setting that meets the criteria for Vasarely's understanding of social art, and these will be weighed and discussed in the nearer future.

Considering the biography of *Canopus* and the artistic theories of Victor Vasarely, especially regarding his multiples, the interpretation of *Canopus'* desired state as well as the rating of the discrepancy between the current and desired state was complex and led to multiple micro-decisions in order to pursue the initial aim. The acknowledgment of the artwork's material and immaterial work-defining properties - as promoted in the model - became existential. For *Canopus* the architectural context builds a work-defining characteristic. The site-specific artwork has been intentionally integrated by the artist in the former college building of the Pedagogical Essen to form a social work of art. Therefore, the discrepancy deriving from the architectural loss fuelled the debate of whether *Canopus* was already lost and should be retired instead of preserved or if it could be reintegrated in a public space for future presentation. The model's focus on the artwork's biography helped to identify and to understand the milestones and turning points in the life of *Canopus* as well as to interpret the current state, the desired state and the potential discrepancy between the two, and finally the meaning of these with regard to the future preservation of the artwork.

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Victor Vasarely: Vasarely Plasticien. Paris 1979.

Endnotes

- 1 Denomination by the artist (Ferrier 1971, p. 27).
- 2 Personal communication, Böttjes Brakebusch, 2 December 2015.
- 3 The contract between the BLB NRW and the CICS, signed in 2015, states that the BLB NRW allocated the artwork *Canopus* to the CICS in order to preferably reinstate the 'original condition', meaning the condition from 2013, before Szabo's intervention, the smearings and felt-tip scribbles.
- 4 Personal communications, Renate Ulrich, former Referent for 'Kunst am Bau' at the BLB NRW, 2016; Personal communication, Dr. Ute Chibidziura, Delegate for 'Kunst am Bau' in estates in the Federal Republic of Germany, 2016; Personal communication, Dr. Johannes Stahl, Curator of Street and Public Art, 2017; Personal communications, Dr. Alexandra Kolossa, Art historian for Public Art and independent consultant for value appraisal, 2018-2020; Personal communications, Prof. Adrian Heritage, Professor for Conservation of Wall paintings and Restoration Ethics, 2016-2018; Personal communications, Gwendoline Fife, Senior research conservator Stichting Restauratie Atelier Limburg, Maastricht, 2015-2018; Personal communications, Alain Colombini, material chemistry engineer, Interdisciplinary Centre for Conservation and Restoration of Cultural Heritage, Marseille, during the conference 'Vandalism & Art', SRAL Maastricht, 8/9 June 2017.
- 5 <https://www.blb.nrw.de/english> (accessed 4 June 2021).
- 6 Personal communication, Dr Alexandra Kolossa (independent consultant for value appraisal), 8 August 2019.
- 7 Internal archive LVR Rheinland, Cultural Heritage Department (Dr. Karoline Friemann, reunion report, 6 October 2004).
- 8 Internal archive LVR Rheinland, Cultural Heritage Department (Dr. Borgmann, reunion report, 3 December 2007).
- 9 Internal Archive Fondation Vasarely (support letter, Therese Yserentant - Pierre Vasarely, 21 August 2019).
- 10 Personal communication, Therese Yserentant, Head of Cultural Heritage / Urban Development at BLB NRW, Region Cologne-Bonn, 8 August 2019.
- 11 Interview with Pierre Vasarely, 20 December 2017, Aix-en-Provence. (Hartmann 2018, Annex e).
- 12 Internal Archive Fondation Vasarely (support letter, Therese Yserentant - Pierre Vasarely, 21 August 2019).
- 13 Exhibitions: Critical Mess 2011; Victor Szabo: Looking back to the future 2014; Kunstwerden: Style Release 2014.
- 14 Personal communication, Robert Kaltenhäuser, 12 September 2017.
- 15 §303 (2) StGB [German penal code: Anyone who unauthorised alters the appearance of another person's property, not only insignificantly and not only temporarily, shall be punished.]
- 16 Personal communication, Sabine Peretzke, coordinator for Public Art, Folkwang Museum Essen, May 2016; Personal communication, Gerd Mahler, Chairman of the jury for art in public, City of Essen, May 2016; Personal communication, Robert Kaltenhäuser, Curator and Art historian for Street Art in the Ruhr valley, June - December 2017.
- 17 Internal archive LVR Rheinland, Cultural Heritage Department (Dr. Borgmann, reunion report, 3 December 2007).
- 18 The copyright for artworks is internationally recognised since the Berne convention in 1886, but it is realised on national levels and therefore varies in different countries. In the case of *Canopus*, the German copyright laws (Urheberrechtsgesetz UrhG) apply and can be summarized as follows: The copyright for works of art is valid in Germany until 70 years after the death of the artist. The artist partly remains the owner of the artwork, particularly of the artistic values. While the owner of the artwork is allowed to exhibit the artwork in its original intended form, it is prohibited to change the artistic, creative idea - also regarding its presentation - without the approval of the copyright holder, who in this case currently is Pierre Vasarely. According to these terms it would be legally permissible for the BLB NRW to detach and store *Canopus*, but also, depending on the interpretation of the §14 UrhG, to either destroy the artwork or to restore and establish a new display.
- 19 Internal archive LVR Rheinland, Cultural Heritage Department (Dr. Karoline Friemann, reunion report, 6 October 2004); Sigrun Heinen, Advisory statement, 9 June 2006).
- 20 The complete documentation concerning the data-registration for *Canopus* can be accessed in Hartmann 2018, pp. 40-60.
- 21 Measurements recorded in 2018 were: 342 × 694 × 0,2 cm.
- 22 Personal communication, Renate Ulrich, 2016.
- 23 Denomination of the artist. In: Vasarely 1979.
- 24 The exact date of the recreation remains unclear. Photographic documentation proves that Victor Vasarely signed *Canopus* once in 1966 with 'Vasarely *65' (Schröder 1992). From 1976, Vasarely

- presented a photograph of *Canopus* with the second creation's signature ('VASARELY-') not only as master study (étude AR 26, 1975) in his mechanical vitrine but also as wall filling reproduction printed on canvas in the Centre architectonique in Aix-en-Provence. In 1979, Vasarely chose to include another photograph, also with the visible new signature in his monograph about the architectural integrations (Vasarely, Joray 1979). It is therefore most likely, that Vasarely ordered, carried out and / or at least accepted the recreation of *Canopus* between 1965 and 1975.
- 25 Interview with Pierre Vasarely, 20 December 2017, Aix-en-Provence.
 - 26 Lower Heritage Protection Authority Essen, Düsseldorf District Government, Department of Art in construction of the NRW State Government, Kunstsammlung NRW.
 - 27 Internal archive LVR Rheinland, Cultural Heritage Department (Dr. Borgmann, reunion report, 3 December 2007).
 - 28 Kristina Brakebusch, Unpublished Conservation Report, 8 January 2015.
 - 29 Pencil sketches on the white paint layers as well as holes of circle tools can be found, but it is not possible to determine, if paper maskings, scotch tape, projections or free hand techniques were used, even if the perfect symmetry of the forms implies the use of maskings.
 - 30 Alkyd-medium became popular as solvent based spray paint binder as it is easy to handle, with no ground preparation necessary, and has fast film-drying properties, which are easily modified and adjusted with fillers, drying agents, plasticizers and other additives. (Learner 2004, pp. 17-18). Cellulose-nitrate is added to the binding medium to raise the durability of the paint layers by increasing the bulk and flexibility of the film. Nowadays acrylic based spray paints are more commonly used as they are less expensive and can be applied without solvents. However, the combination of alkyd and cellulose-nitrate in product names often advertised as 'Nitro-lacquers' is known for high-priced qualitative spray paints with high opacity, finest pigmentation, clear and even colouring, and high stability of the dry paint films due to physical and chemical drying processes (Kittel 2017, pp. 122-161, Confirmed by personal communication, Robert Kaltenhäuser, 12 September 2017).
 - 31 The smears of organic material have already reacted with the paint and changed surface structures. In addition, red dye has migrated into the white paint and plaster layer. The scribbles with black felt-tip markers have also migrated into the paint layer and are therefore optically improvable but technically irreversible.
 - 32 Publications designate different years for this Black and White period. Victor Vasarely himself chose the classification 'Noir-Blanc (1951-1963)' for the title page of his présentoirs N1 and N2 in Gordes in 1970.
 - 33 *Art should be social* - present in daily life, colouring cities, universally understandable and available to all (Vasarely 1973, p. 60). *Multiplication or magnification* of an artwork is used to reach as many people as possible (Victor Vasarely: Les Multiples. 1967. In: Ferrier 1971, p. 167). The ultimate ambition is the creation of *The Polychrome City*: realisation of an ideal symbiosis of art and architecture to brighten up and introduce colour to public spaces, streets and in particular the grey industrial cities with their simple and colourless council housings (Vasarely 1973, p. 82).
 - 34 The '*original*' is replaced by the idea of '*prototypes*' - miniature graphics of compositions which can be realised in a great variety of materials, techniques, and formats and which can be '*permutated*' by changing colours or single parts of the composition (Spies 1971, p. 119). Vasarely considered his prototypes as true originals, as the manifestation of the plastic idea, 'the starting point'. He used them like 'programmatic scores' and created his prototypes based-on multiples in various dimensions and materials. (Vasarely 1973, p. 29).
 - 35 The so called "Yellow Manifest" was published by Victor Vasarely, Pontus Hulten and Roger Bordier, and promoted by the exhibiting working group at the Galerie Denise René in 1955 naming the artists Schöffer, Tinguely, Soto, Agam, Bury, Vasarely and sponsored by Calder and Duchamp (Vasarely et al. 1955).
 - 36 In the archives of the Fondation Vasarely, Aix-en-Provence, there are numerous telegrams, discussions and demands documenting correspondence between Victor Vasarely and different craftsmen (mosaic, painting, tapestry, etc). The unpublished correspondence prove that Victor Vasarely tested, analysed and approved new materials before using them in one of his integrations.
 - 37 Unpublished documents that are archived by the Fondation Vasarely describe damage caused by visitors' interaction as well as yellowing or fading of certain paints which were observed on the integrations owned by the Fondation Vasarely.
 - 38 The 'plastic creator' chooses the composition, but the realisation is not bound to his own hands if she / he signs the artwork or is present during the creative process (Victor Vasarely: 1967. Les multiples. In: Ferrier 1971, p. 167).
 - 39 Personal communication, Pierre Vasarely 20 December 2017.

- 40 Interview with Pierre Vasarely, 20 December 2017.
- 41 *Vandalism* is not a fixed legal term. In general, it is applied to name the “unlawful, malicious and reckless destruction of property and valuables” (Demandt 1997, p. 19) but the application of this term in the context of art is difficult. Artistic over-painting of art and cultural assets have been carried out many times in history (e.g. baroque paint layers on renaissance sculptures), not in order to destroy but for various other reasons such as adapting the artwork to a new fashion or to cover aged or degraded surfaces (Althöfer 1985, p. 9).
- 42 Persecution according to German Criminal Code (StGB) § 303 - Damage to property, Limitation of persecution: 5 years.
- 43 The artist and curator for Street Art, Robert Kaltenhäuser, gave an expertise on Victor Szabo and his artwork in 2017, based on multiple meetings, collaborations, and an interview with Szabo in 2011-2017. For Kaltenhäuser, it is unquestionable that Szabo was not interested in destroying or violating Canopus. He is also certain that Szabo is not interested in the preservation of his artwork nor in its communication to the public (Personal communication, Robert Kaltenhäuser, 12 September 2017).
- 44 Flower-plots are inspired by the OECD Better Life Index originally designed by Moritz Stefaner. Each

conservation option is represented by a flower, each variable by one of its petals. The length of a petal is proportional to the mean value of the respective variable over all raters. The height of each flower is proportional to the sum over the lengths of its petals. Figure 4 was created with the qqBaseX package for the R software environment, available for free (<https://github.com/AndreasFischer1985/qqBaseX>).

A spider-plot (also known as spider chart or radar chart) is a two-dimensional chart consisting of a sequence of equi-angular spokes of equal length, with each spoke representing a variable. For each conservation option, the mean value over all raters is represented for each variable as a point on the corresponding spoke, with the distance to the centre being proportional to the size of the respective mean. Additionally, for each conservation option the standard deviation over all raters is represented by lines around the corresponding mean value. For better readability the visual representation of each conservation option has been slightly rotated around the centre of the chart. Figure 5 was created with the qqBaseX package for the R software environment, available for free (<https://github.com/AndreasFischer1985/qqBaseX>).