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HYBRID CREATIVE PROCESSES IN ART INSTALLATIONS USING MIXED REALITY: The VAP project and the XR reinterpretation of Javier Riera's work

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ABSTRACT
This article analyzes the VAP – Virtual Art Processes project as a methodological model of hybrid creative processes in contemporary art installation using mixed reality. From a practice-based artistic research approach, the conceptual and technical development of a hybrid installation that integrates physical and virtual components from the initial phases of the creative process is described. The study is based on the reinterpretation of Javier Riera's work and is complemented by a public evaluation carried out at the European Researchers' Night, the results of which show the potential of mixed reality as an active phase of the artistic process.

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1. Introduction

Since the second half of the twentieth century, contemporary art installation has been configured as a site-specific, experiential and often ephemeral practice, in which the meaning of the work emerges from the relationship between space, materiality, light and the presence of the viewer. This *site-specific* and temporal condition, which constitutes one of its fundamental values, poses at the same time important challenges in terms of conservation, documentation and critical reappropriation, especially when the work depends on environmental and perceptual conditions that are difficult to reproduce outside its original context. In this sense, analyzes of space as a structural element of installation have been widely addressed by authors such as Maderuelo (1990) or by artists whose practice focuses on perceptual experience, such as Turrell (1993) and Eliasson (2012).

In recent decades, immersive technologies—Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR)—have opened up new avenues to address these challenges. In the first stage, these technologies have been used mainly as tools for reconstruction, visualization or preservation of ephemeral installations, allowing the recording and re-experiencing of disappeared or inaccessible works. However, this instrumental use of technology has tended to situate the virtual as a space of representation after the work, subordinated to the pre-existing artistic object (Grau, 2002).

Faced with this approach, the recent development of Extended Reality (XR) environments raises the possibility of a relevant conceptual displacement: the incorporation of the virtual not only as a means of documentation or exhibition, but as an active phase of the creative process. In this context, Mixed Reality is presented as a hybrid environment in which physical and digital elements coexist and affect each other, generating perceptual experiences that do not belong entirely to either the material or the virtual space. This hybrid condition is particularly relevant to the artistic installation, whose language is articulated precisely around spatial perception, the viewer's corporeality and sensory activation. Studies on presence and immersive experience, such as those by Lee (2004), Slater (2007) or Averbukh (2014), have contributed to consolidating this perceptual approach.

The VAP – Virtual Art Processes project arises in this framework as interdisciplinary artistic research aimed at analyzing and developing creative methodologies in artistic installations that integrate XR technologies from the initial phases of the process. Unlike previous experiences focused on the virtual recreation of existing works, VAP proposes a working model in which the work is conceived from its origin as an assemblage of physical and virtual components, exploring how this hybridization transforms the notion of materiality, scale and relationship with the viewer. In parallel, the evolution of XR in museum contexts—as noted by Komianos (2022) and Innocente et al. (2023)—demonstrates the growing interest in hybrid devices that redefine the visitor experience.

In its first phase, the project is structured around the reinterpretation of the work of the artist Javier Riera, whose practice is characterized by geometric intervention in the landscape and the investigation of light as a structural element of the perceptual experience. The conceptual affinity between his work and the possibility of Mixed Reality makes this case an ideal framework to analyze how XR technologies can expand, without replacing, the material and spatial logic of contemporary art installation.

From this perspective, the main objective of the second phase is to analyze the VAP project as a methodological model of hybrid creative processes, describing both its conceptual approach and its technical development, and assessing the potential of Mixed Reality to redefine the limits of the aesthetic experience in contemporary art installation. The light and geometric dimension of his work dialogues directly with the perceptual approaches of artists such as Cruz-Díez (2009) and with contemporary immersive practices such as those studied by Cabañas (2020) in relation to TeamLab.

2. Theoretical framework: artistic installation, perception and Extended Reality

The artistic installation is defined, since its consolidation in the field of contemporary art, as a practice that shifts the center of the work from the autonomous object to the spatial and bodily experience of the viewer. Unlike traditional formats based on frontal contemplation, the installation articulates meaning through the relationship between space, time, route and perception, placing the visitor as an active agent in the construction of meaning. This experiential condition implies that the work is not exhausted in its materiality but is actualized in each perceptual activation. This conception of the installation as a perceptual event finds parallels in studies on space and the phenomenology of artistic experience

developed by authors such as Maderuelo (1990), who delve into the articulating nature of space in the construction of meaning.

Various authors have pointed out that the artistic installation operates as a perceptual device rather than as a closed artifact, in which the space ceases to be a mere container to become a structural component of the work. In this sense, the aesthetic experience is built from the interaction between body, environment and materiality, giving rise to situated and contingent forms of perception. This logic is especially relevant in those practices that work with light, transparency or geometry, where perception is modulated by environmental conditions and by the position of the viewer. This approach dialogues with the research of artists such as Turrell (1993) or Eliasson (2012), who have shown that light, scale and spatial variation can constitute the core of the artistic experience without depending on a stable material object.

The ephemeral nature and site-specific installations of many contemporary installations have historically posed problems in terms of conservation, documentation and transmission. In contrast to the stability of the traditional artistic object, the installation depends on spatial, temporal and perceptual variables that are difficult to fix. In this context, digital technologies have initially been used as tools for recording or reconstruction, allowing experiences to be documented that would otherwise disappear once the work has been dismantled. In the first theoretical analyzes of digital art and immersive illusion collected by Grau (2002), it is highlighted how emerging technologies have acted as instruments of preservation before becoming autonomous creative media.

However, the incorporation of immersive technologies has opened a field of research that goes beyond mere documentation. VR, AR and, especially, MR, allow direct intervention in the conditions of perception, expanding or transforming the spatial experience without eliminating the presence of the body or the real environment. This possibility is particularly significant for the artistic installation, whose logic is based precisely on the activation of the space and the viewer. Studies on presence, such as those by Lee (2004), Slater (2007), and Averbukh (2014), emphasize this idea by demonstrating that perceptual quality and the sensation of being-in-space depend on a dynamic relationship between body, environment, and sensory stimuli, which is fundamental to understanding the immersive potential of Mixed Reality.

From the model of the reality-virtuality continuum proposed by Milgram and Kishino, Mixed Reality is situated in an intermediate territory in which physical and digital elements coexist and influence each other. Unlike Virtual Reality, which builds a completely synthetic environment, Mixed Reality maintains a direct reference to real space, integrating virtual layers that are anchored to shared physical coordinates. This hybrid condition allows the preservation of the viewer's corporeality and the materiality of the environment, while introducing perceptual dimensions that are not accessible on the exclusively physical plane. This approach has also been corroborated in studies applied to the museum field, where research such as that of Komianos (2022) and Innocente et al. (2023) shows how XR allows the integration of information, spatial narrative and interpretative layers without cancelling out the presence of the object or exhibition space.

In the field of contemporary art, this hybridization has given rise to practices that cannot be understood only as digital works or as traditional installations. These are hybrid assemblages in which the aesthetic experience emerges from the articulation between material, spatial and virtual elements. In this context, the virtual ceases to be a secondary representation to become a structural component of the work, capable of modifying its meaning, its scale and its relationship with the viewer. The consolidation of these practices also finds references in the art of light and color —such as that of Cruz-Díez (2009)— or in large-scale immersive experiences such as those studied by Cabañas (2020) in relation to TeamLab, which demonstrates the growing expansion of hybrid formats that overflow traditional disciplinary borders.

From a critical perspective, authors such as Walton have pointed out that XR technologies not only introduce new media but alter the way in which the virtual "comes to matter" in perceptual and ontological terms. Instead of operating as simulations separate from reality, these hybrid environments generate experiences in which the distinction between the real and the virtual loses relevance in the face of lived experience. This approach is especially pertinent to the artistic installation, where the meaning does not lie in representational fidelity, but in the perceptual activation of the viewer. Along the same lines, studies on creativity and flow such as those by Csikszentmihalyi (1996, 2007) and Austin (1978) allow us to understand these hybrid practices as dynamic processes in constant modification, where formal decisions are developed in direct interaction with the technological means used.

In this conceptual approach, MR can be understood not only as a visualization technology, but as a creative environment that directly affects the artistic process. The possibility of designing works that unfold simultaneously on the physical and virtual plane forces us to rethink notions such as materiality, form, scale and temporality. The work is no longer conceived as a closed object, but as a relational system that is activated according to the position, movement and interaction of the viewer. This processual character connects again with the approach to contemporary digital art described by Villagómez-Oviedo (2019), who underlines the iterative, experimental and transversal nature of the processes of creation in digital environments. This iterative and open nature of the creative process connects directly with the models of creativity developed by Csikszentmihalyi (1996, 2007), who understands creativity as a dynamic system based on the interaction between the individual, domain and context, as well as with Austin's (1978) approaches to the role of chance, exploration and decision-making in creative environments.

The VAP project is part of this line of research, proposing a methodological shift: instead of applying XR technologies to existing works, the integration of Mixed Reality is proposed from the initial phases of the creative process. This approach allows us to analyze how technical and perceptual decisions condition the final form of the work, as well as its aesthetic experience, placing technology as a constituent part of the artistic method and not as a later addition.

3. Methodology

3.1. Methodological approach of the VAP project

The VAP project is part of the field of practice-based artistic research, understood as an iterative process in which theory, material experimentation and technological development feedback on each other continuously. This approach assumes that the knowledge generated is not limited to the final results, but emerges from the decisions, tests, and adjustments made throughout the creative process.

The methodology adopted is based on the lessons learned in previous research focused on Virtual Reality applied to the recreation of artistic installations, in which the limitations of completely virtual environments were identified to generate a perceptual experience fully integrated with the viewer's body and real space. Based on these conclusions, VAP shifts the focus to Mixed Reality as a priority work environment, by allowing a direct relationship between the physical work, the architectural space in which it is inserted, and the superimposed digital layers.

From the methodological point of view, VAP does not pursue in this phase the production of a closed artistic work, but the exploration of a previous experimental field, aimed at defining criteria and variables that can be applied later in projects of greater scale and complexity. This methodological orientation is aligned with studies on digital creation processes such as those by Villagómez-Oviedo (2019), which highlight the importance of material experimentation, constant iteration and immediate feedback between concept, prototype and test as backbone elements of contemporary creation in hybrid environments.

3.2. Design of the hybrid creative process

As a fundamental premise of the project, it is established that the work must have a real physical presence, conceived from the beginning to be completed or expanded through a Mixed Reality experience. This decision responds to the need to avoid an exclusively virtual experience that is alien or disconnected from the viewer, reinforcing instead the continuity between material perception and digital perception. A hybrid conception of the creative process is produced that dialogues with the notion of "systems of creativity" proposed by Csikszentmihalyi (1996), in which cultural production does not arise from a single support, but from the interaction between multiple levels of action and feedback.

From this premise, and alluding to technical development, the creative process is structured around a set of variables designed to generate a wide field of experimentation:

- Morphology: exploration of geometric designs based on straight lines and modular structures, in coherence with the artist's formal language.
- Multiplication and repetition: study of matrix variations of the base design, considering their perceptual behavior in different densities and spatial configurations.

- Scale: prototyping and development of object-sized pieces and spatial panels, analyzing how scale conditions the relationship between body, space and virtuality.
- Materiality: experimentation with physical materials such as methacrylate, laser-cut wood and parts printed in PLA and PET, selected for their properties of transparency, reflection and refraction. The analysis and evaluation of minimum print thicknesses was one of the critical aspects of the experimental process.
- Position and orientation: analysis of supported, suspended, vertical or horizontal pieces, with a neutral or variable background, and with the possibility of being surrounded or crossed by the viewer.
- Spatial relationship: study of the relationships between physical and virtual elements in terms of superposition, relative distance, movement, rotation and three-dimensional composition.

These variables are combined in different iterations, selected and adjusted in dialogue with the artist, in order to define configurations that are significant both on the material plane and in their virtual extension. This iterative approach is consistent with the model described by Villagómez-Oviedo (2019) on digital creation, where the process is conceived as a continuous cycle of design-prototyping-evaluation that allows understanding and adjusting the relationships between the physical object and its digital dimension.

3.3. Technical implementation of the Mixed Reality experience

The technical development of the physical prototypes is complemented by the experience using the Meta Quest 3 headset, selected for its ability to operate in standalone mode to offer spatial tracking of six degrees of freedom (6DoF). This feature allows the user to move freely around the real piece, maintaining a direct relationship between their body position and the perception of the overlapping virtual elements.

The experience is developed using Epic Games' Unreal Engine graphics engine (version 5.5), structuring each experimental setting as a separate scene. All the scenes share the same spatial conditions and base lighting, varying only the point of observation and the virtual pieces that complete the physical work.

From the perspective of the creative process, this simultaneous work between physical prototypes and digital scenes coincides with Romo's (1997) descriptions of creativity as the integration of different modes of representation, as well as with the emphasis on experimental prototyping described by Villagómez-Oviedo (2019).

Since the system works without connection to an external computer, one of the main conditioning factors of the process is graphic optimization. To do this, the number of faces is precisely optimized and PBR (Physically Based Rendering) materials are used, adjusting parameters such as transparency, reflection, roughness, opacity and refraction, in order to approximate the visual behavior of the digital materials to that of the physical elements used in the installation. The lighting of the virtual environment is solved by using an HDRI image captured in the showroom itself, which allows the real lighting conditions to be consistently integrated into the calculation of reflections and shadows of the virtual pieces. In one of the experimental configurations, a basic system of interaction is also incorporated that activates the animation of a virtual element through the action of the user, introducing a dimension of co-creation that modifies the traditional relationship between viewer and work. This type of interaction is aligned with psychological approaches to creativity such as those proposed by Csikszentmihalyi (2007), where the active participation of the individual is understood as a fundamental engine to generate meaningful experiences.

4. Development of the VAP hybrid installation

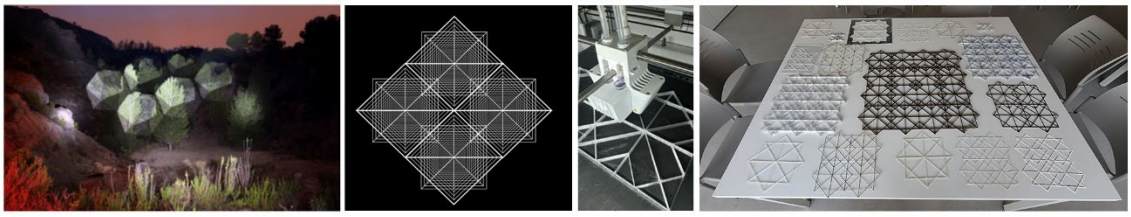
4.1. Spatial configuration and arrangement of the parts

The installation developed within the framework of the VAP project was conceived as a hybrid device in which the physical work and its virtual extension are articulated in the same architectural space, maintaining a direct relationship with the viewer's body position. The selected environment was an interior space with controlled lighting conditions, which made it possible to minimize external interference and guarantee perceptual coherence between the material and digital elements.

The spatial configuration was organized in three independent observation sets, located within the same exhibition space. Each set was associated with a specific physical piece and a specific Mixed Reality experience. Although the three experiences shared the same architectural setting, there was no narrative continuity between them; these were autonomous experiences, designed to be lived individually and not sequentially as the modular structure of Csikszentmihalyi's (1996) models of systemic creativity, in which each creative node operates as an independent unit within a larger system.

In all cases, the initial observation point was established approximately one meter from the physical piece. This point functioned as a perceptual anchor between the real and the virtual, allowing the viewer to first recognize the material object before activating the immersive experience. Once the experience began, the user had freedom of movement around the piece, favoring an active spatial exploration of the relationship between both levels of the work. The importance of this transition between recognition and exploration is related to Romo's (1997) processual descriptions of creativity as an exploratory experience guided by perception and movement.

Figure 1. Process: Real intervention on the landscape (Javier Riera) _ Previous geometric design (Javier Riera) _ 3D prototyping _ Material and texture tests of the physical object.



4.2. Physical prototypes and material tests

The physical pieces used in the installation were conceived as experimental prototypes, not as definitive works, in coherence with the exploratory nature of this first phase of the project. These prototypes were developed from a basic geometric design selected by the artist, which was subsequently subjected to formal, material and scalar variations.

Tests were carried out with different materials, among which the following stand out:

- Laser-cut mirror methacrylate (2 mm), used for its ability to generate reflections and visual duplications of the environment.
- 3D printed PLA plastic, used to explore opaque volumes and color relationships.
- 3D printed PET plastic, selected for its transparency and lightness properties, facilitating traversable configurations and vertical overlays.

These parts were produced using digital fabrication technologies, combining laser cutting and 3D printing, which allowed for a high degree of formal control and rapid iteration between design and materialization. The diversity of materials and physical configurations was key to analyzing how each of them conditioned its subsequent translation into the virtual environment. It is an experimental procedure by successive iterations that fits the digital creation model described by Villagómez-Oviedo (2019), where physical and digital prototyping works as a continuous feedback sequence.

4.3. Translation of the physical part into the virtual environment

The virtual extension of each piece was not conceived as an exact replica of the physical object, but as a coherent reinterpretation of its formal and material properties. The aim was not to duplicate reality, but to amplify it, exploring spatial relationships impossible on the material plane, such as dynamic superimpositions, extrusions, continuous rotations or volumetric multiplications.

To ensure perceptual continuity between the two levels, special attention was paid to the correspondence between:

- physical geometry and virtual geometry,
- optical behavior of the real material and its digital simulation,
- the spectator's body scale and the scale of the virtual elements.

This translation was carried out in an iterative way, adjusting the virtual pieces based on the tests carried out with the physical prototypes and the direct experience of the research team in the exhibition space, carrying out a process that is aligned with the notion of creativity as a cycle of refinement

proposed by Csikszentmihalyi (2007), in which the creator continuously evaluates the results of his experiments and generates new variations from them.

Figure 2. Piece 01 _ Mirror methacrylate (2 mm), laser-cut _ Physical piece _ Virtual piece in overlapping and rotating movement.



Figure 3. Piece 02 _ 3D-printed PLA _ Physical piece _ Virtual piece with extrusion and color overlay.

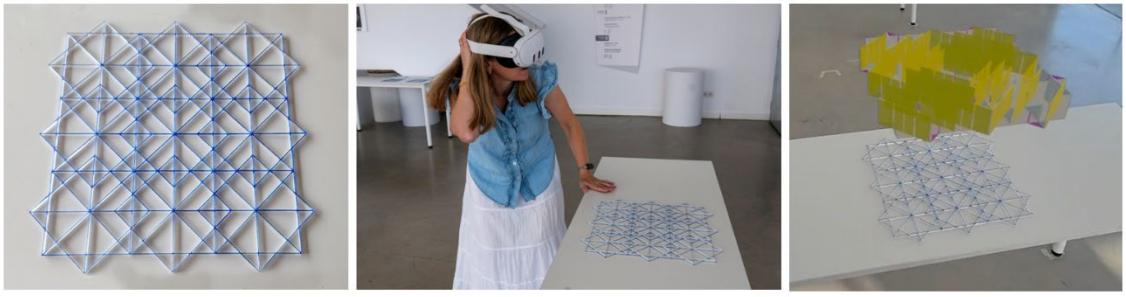


Figure 4. Piece 03 _ 3D-printed PET _ Physical piece _ Virtual piece in vertical, traversable overlap.



4.4. Lighting, digital materiality and interaction

One of the central aspects of the technical development was the integration of real lighting into the virtual environment. To do this, an HDRI image captured in the showroom itself was used, applied as a lighting environment in Unreal Engine. This strategy made it possible to generate coherent reflections and shadows between the virtual pieces and the physical space, reinforcing the feeling of material continuity.

The digital materials were developed using a PBR model, prioritizing parameters such as transparency, refraction and reflection, in line with the physical materials used. In one of the experiences, an interaction element was also incorporated, through which the user could activate the animation of a virtual piece by approaching the hand and operating the controller. This interaction introduced a dimension of co-participation, modifying the traditional relationship between spectator and work and reinforcing the processual character of the installation. This component of active participation connects with Romo's (1997) approaches to experiential creativity, where bodily involvement and gesture are considered significant elements in the construction of meaning.

4.5. Documentation and preparation for public exhibition

The entire development process—from physical prototypes to final virtual configurations—was documented through photographic records, schematics, and captures of the virtual scenes. This material not only fulfilled an archival function but was also integrated into the exhibition discourse of the European Researchers' Night, promoted by the Madri+d Fundación para el Conocimiento, favoring an understanding of the installation not only as a final result, but as a process of ongoing artistic research. This integration of the process as part of the exhibition discourse is consistent with the perspectives of digital creation identified by Villagómez-Oviedo (2019), where the process acquires an epistemic value equivalent to the final result.

5. Case study: geometry, light and perception in the work of Javier Riera

Javier Riera's work is characterized by sustained research into the relationship between geometry, light and landscape. Through light interventions on natural or architectural environments, the artist introduces geometric structures that do not replace the existing space but reveal and reconfigure it perceptually. Geometry acts, as well as a mediating device that allows the viewer to perceive the environment from an enlarged logic. This relationship between geometry, light and perception is part of a tradition that can also be observed in the practices of artists such as Cruz-Díez (2009), Turrell (1993) and Eliasson (2012), who have explored the capacity of light to transform the spatial experience without physically altering the environment.

One of the distinctive features of their practice is the non-invasive nature of the intervention. Light projections do not physically alter the space, but they generate an intense and transformative perceptual experience. This ephemeral condition places the work on a threshold between presence and disappearance, reinforcing the idea of the installation as a temporary and situated experience. The work is not preserved as an object, but as a perceptual memory. This commitment to the ephemeral and perceptual transformation finds parallels with contemporary immersive experiences such as those collected by Cabañas (2020) in his analysis of the TeamLab collective, where light and geometry articulate hybrid environments that activate the viewer.

From the formal point of view, the geometry used by Riera is not presented as a closed system, but as an open structure that dialogues with the irregularities of the environment. Geometric shapes do not impose an abstract order, but adapt to the topography, vegetation or existing architecture, generating tensions between the organic and the rational. This dialectic is key to understanding the affinity of his work with hybrid Mixed Reality environments. This dialogic behavior between geometry and space is related to Villagómez Oviedo's (2019) descriptions of hybrid creation systems, in which design is not established as a rigid structure but as a process adaptable to the conditions of the environment and the user experience.

Light, in this context, functions as the main material. It is not merely an illuminating element, but a medium capable of building space, delimiting volumes and activating perceptual routes. The viewer's experience is conditioned by position, distance and angle of view, so that the work is continuously reconfigured according to bodily displacement. This experiential dimension connects directly with the principles of contemporary art installation. The centrality of body movement and mutable perception finds theoretical support in approaches to experiential creativity, such as those of Romo (1997), for whom sensory and motor mobilization play a crucial role in the construction of meaning.

The affinity between Riera's practice and MR does not lie only in the use of projection technologies, but in a shared conception of the work as a relational perceptual structure. As in the MR, Riera's work is not exhausted in a fixed point of view, but unfolds in space and time, activating itself in the interaction with the viewer. This logic makes his work a particularly suitable framework for exploring hybrid creative processes.

In the context of the VAP project, the reinterpretation of Riera's work is not proposed as a literal translation into the virtual environment, but as a process of analysis and expansion of its formal and perceptual principles. Geometry, transparency and the relationship with space become variables that can be explored simultaneously on the physical and virtual plane, allowing configurations that are impossible to materialize only by means of light projection to be tested. This type of modular and experimental exploration coincides with the notion of creativity as a dynamic system proposed by

Csikszentmihalyi (1996) and with the models of creative iteration described by Villagómez-Oviedo (2019).

The introduction of mixed reality makes it possible, for example, to multiply geometric structures, generate dynamic overlays or modify the scale without physically altering the environment. These operations do not seek to replace the original experience, but to expand its perceptual possibilities, maintaining the conceptual logic of the work. The physical piece acts as a material anchor, while the virtual layer introduces a space for experimentation that dialogues with it. It is a dialogue between perceptual levels that has parallels with the immersive practices studied by Cabañas (2020), where light, dynamic geometries, and digital environments coexist with physical structures to generate sensory expanded experiences.

From a methodological perspective, this approach reinforces the idea of Mixed Reality as an active phase of the creative process. Decisions regarding geometry, materiality and lighting are not made independently of the XR environment but are adjusted according to its hybrid behavior. In this way, the final work cannot be understood without considering the technological device that articulates it. This integration between technical decision and artistic sense coincides with the description of creative processes proposed by Austin (1978), where creative action is configured as an interaction between intention, experimentation and discovery.

Javier Riera's case study thus allows the VAP project to be placed in a solid artistic framework, avoiding a purely technocentric reading. Technology is not presented as an end in itself, but rather as a means of engaging more deeply with the central concerns of contemporary art installation: perception, experience and the relationship between space, body and form. This articulation between artistic practice and technological development constitutes one of the main contributions of the project to the field of research in visual culture. In this sense, the hybrid perspective of the project is aligned with the digital creation approaches described by Villagómez Oviedo (2019), which conceive the creative process as a network of interactions between materiality, perception, technology and artistic decision.

6. Public exposure and collection of empirical data

6.1. Exhibition context: European Researchers' Night

As part of the development of the VAP project, a public exhibition was organized within the framework of the European Researchers' Night, held in the Hall of Building K of the Faculty of Communication of the Universidad Francisco de Vitoria. The exhibition presented the first experimental phase of the project, showing physical prototypes, documentation of the creative process and an immersive experience in Mixed Reality inspired by the work of Javier Riera. The use of exhibition spaces as platforms for experimentation and interaction with the public is close to models of contemporary digital creation described by Villagómez Oviedo (2019), for whom public interaction constitutes a significant phase in the validation and adjustment of the creative process.

The exhibition approach was not merely informative, but was conceived as a research device, allowing the interaction of the public with the physical and virtual pieces to be observed, as well as collecting data on perception, expectations and assessment of the experience. The exhibition catalog documents both the conceptual framework of the project and the structure of the route and the profiles of the research team. This discursive and processual approach coincides with the dynamics of creative experimentation described by Romo (1997), where the public phase is understood as a key moment to contrast perceptual hypotheses and adjust creative decisions.

This expository context constitutes the framework in which the empirical data analyzed in the following section were collected.

6.2. Design of the PRE and POST surveys

To evaluate the impact of the experience, two differentiated questionnaires were designed:

- PRE survey, administered before the immersive experience, aimed at collecting information on:
  - prior knowledge of the artist's work,
  - interest in immersive installations,
  - expectations regarding exposure,
  - previous familiarity with VR/AR technologies.
- Post-experience POST survey focused on:

- general assessment of the exhibition,
- perceptual impact of the XR experience,
- identification of the most significant elements,
- Appreciation of the connection between art and technology.

Both questionnaires combined closed ordinal scale questions with brief open questions, allowing the collection of descriptive data on expectations, perception and evaluation of the experience. This type of mixed instruments coincides with models of analysis of the creative process pointed out by Csikszentmihalyi (1996), who highlights the importance of combining qualitative and quantitative measurements to capture the complexity of experience.

6.3. Descriptive synthesis of the PRE and POST results

The results of the PRE and POST surveys show an audience mostly unfamiliar with Javier Riera's work, but with a high previous interest in immersive installations and an emotional disposition marked by curiosity. After the experience, the overall assessment was largely positive, with the Mixed Reality experience standing out as the most significant element of the visit. This type of reception pattern—initial curiosity, perceptual impact, and positive valuation of the hybrid experience—coincides with the analyzes of contemporary reception of immersive art collected by Cabañas (2020), especially in contexts where technology functions as a facilitator of expanded perceptual access.

These descriptive data form the basis for the analysis and interpretation developed in the following section, dedicated to the discussion of the results in relation to the methodological model proposed by the VAP project.

7. Results and discussion: public evaluation at the European Researchers' Night

7.1. Baseline profile and audience expectations (PRE)

Based on the data collected during the public exhibition described in the previous section, the PRE survey (n = 21) allows us to characterize the framework of reception of the installation: most of the participants did not previously known Javier Riera's work (17/21 "No", 1/21 "Un poco"), while only 3/21 said they knew it.

Despite this lack of knowledge of the artistic reference, the declared interest in immersive installations was high: 14/21 placed their interest at high or very high (12 "High", 2 "Very high"), compared to 6 "Medium", 1 "Null" and 0 "Low". This initial pattern—curiosity, openness, and low prior knowledge—coincides with the models of situational creativity described by Romo (1997), in which the individual's affective predisposition functions as a catalyst for creative and perceptual experience.

In relation to what they expected to find in the exhibition, expectations were distributed between a technological experience (10/21) and an aesthetic experience (9/21), with the reflective/conceptual expectation (2/21) being far below.

In affective terms, the predominant state before the experience was curiosity (15/21), followed by expectation (5/21). This type of emotional disposition is in line with the notion of "potential flow" described by Csikszentmihalyi (1996), where curiosity functions as a gateway to immersive experiences that can activate deep engagement processes.

This profile is relevant for two reasons: (a) it reduces the possible bias for "expert audience" in the artist (under prior knowledge), and (b) it indicates that the installation is received from a favorable disposition toward the immersive, but not necessarily from conceptual frameworks of site-specific installation or light-geometry practice in landscape. This reinforces the value of the VAP device as an autonomous artistic mediation, capable of activating the experience without requiring prior knowledge of the context of Javier Riera.

7.2. Assessment of experience and perceived effect (POST)

The POST survey (n = 20) shows a very positive overall assessment: 18/20 rated the experience as "Excellent" or "Very Good" (9 and 9 respectively), and 2/20 as "Good"; no "Regular" or "Poor" ratings were recorded.

Regarding the impact of the installation on the perception of immersive art, 16/20 stated that the experience changed their perception "a lot" or "a lot" (12 "Quite", 4 "A lot"), and 4/20 "Somewhat".

When asked about the most significant or surprising element, the experience with XR glasses is clearly ranked as the most selected option (11/20), followed by conceptual reflection (5/20) and prototypes/models (3/20); only 1/20 selected "Javier Riera's work with light and geometry" as the main aspect. This shift of focus toward the hybrid experience (physical piece + XR layer) coincides with the type of reception described by Cabañas (2020) in contemporary immersive environments, where the technological component operates as a catalyst for expanded perception.

As for the sensations experienced, the responses were concentrated in positive categories: 15/20 "interesting" and 5/20 "very immersive", with no records of confusion or neutrality.

Finally, the art-technology connection was perceived as innovative: 12/20 answered "Yes, totally", 7/20 "Yes, in part", 1/20 "Not much" and 0/20 "Nothing". This perception of innovation dialogues with Villagómez Oviedo's (2019) model of distributed creativity, where the interaction between media, technologies, and materialities generates new forms of experience and artistic meaning.

7.3. Discussion.

The data point to a consistent pattern: the experiential core that the public identifies as most significant is not the isolated physical object or the artist's knowledge, but the hybrid assemblage (work + XR layer) that produces a situated experience. E This centrality of hybrid interaction coincides with the frameworks of experiential creativity of Csikszentmihalyi (2007), for whom the value of experience depends on the active interaction between subject, environment and stimuli. This is consistent with VAP's methodological approach: three observation sets, an initial observation point at 1 meter, 6DoF freedom, the use of Meta Quest 3 in *standalone mode*, and a development in *Unreal Engine 5.5* conditioned by optimization of materials and lighting.

From an artistic research point of view, this empirical evidence – although exploratory and descriptive – supports the operational hypothesis of the project: Mixed Reality does not operate only as an "exhibition layer", but as an active phase of the creative process, conditioning decisions of materiality, scale, perception and position of the viewer with respect to the real piece. The exhibition itself was conceived as a presentation of a "first phase" based on material testing and integration with AR/MR, acting as a bridge between the tangible and the virtual.

7.4. Limitations of the study and scope of the results

The results should be interpreted as an exploratory evaluation of an initial phase (prototypes + XR tests) and with a limited sample (n=21; n=20).

Consequently, the objective is not to infer population generalizations, but to identify reception trends useful for iterating the design of the device: relevance of the observation point, clarity of the real-virtual anchoring and weight of the immersive component as a central factor of significance. This iterative approach is in line with the models of digital creation and continuous experimentation described by Villagómez Oviedo (2019), where prototypes function as instruments of reflection and methodological adjustment.

From a comparative perspective, the results obtained allow us to place the VAP project in contrast with other common uses of XR technologies in the artistic field. In many cases, virtual or augmented reality is used as a tool for documentation, reconstruction or exhibition mediation of existing works, maintaining a clear separation between the creative process and the technological device. In the VAP project, on the other hand, Mixed Reality is integrated from the initial phases of the process, directly conditioning the formal, spatial and material decisions of the installation.

This difference is key to understanding the perceptual impact observed on the audience experience. The positive assessment cannot be attributed solely to the use of immersive technology, given that a significant portion of the participants already had previous experiences in VR or AR. The transformative effect indicated in the POST surveys seems to be related to the coherence between the physical piece and its virtual extension, as well as to the clarity of the spatial anchorage between both levels. Mixed Reality acts here as an integrated perceptual environment, not as a spectacular overlay element. This type of multisensory coherence is part of the contextualized creativity dynamics described by Csikszentmihalyi (1996), where the user's interaction with a structured environment triggers new forms of perception and appreciation.

Likewise, the data reinforce the hypothesis that the hybrid experience modifies the traditional relationship between viewer and work. The freedom of movement (6DoF), the possibility of

surrounding the physical piece and the visual correspondence between real and digital materiality generate a situated experience that requires active bodily participation. This aspect connects with theories of the artistic installation as an experiential practice, in which meaning emerges from the path, duration, and position of the body in space. This active role of body movement also coincides with Romo's (1997) perspectives on the role of action in perceptual and creative processes.

However, the results also highlight certain limitations inherent in the current use of Mixed Reality technologies in exhibition contexts. The need for graphic optimization in standalone devices, the restrictions in resolution and field of view, as well as the mediation of control interfaces, condition the design of the experience and require a constant negotiation between aesthetic ambition and technical feasibility. These limitations, far from invalidating the proposed model, underline the importance of considering the technological framework as a constituent part of the creative process.

In this sense, the VAP project contributes to shifting the debate from an instrumental conception of XR to a broader methodological understanding, in which technology is not evaluated only by its capacity for representation, but by its potential to generate new forms of perception and knowledge in the field of contemporary art installation. This conceptual shift is consistent with the models of hybrid creation described by Villagómez Oviedo (2019), where technology actively participates in the construction of the artistic sense.

These results allow us to draw a series of general conclusions about the potential of mixed reality as an active phase of the creative process in contemporary art installation, which are developed below.

8. Conclusions and future lines

The first phase of the VAP project allows us to draw three main conclusions:

- The hybrid installation works as an artistic mediation device, even when the audience does not previously know the artist. The PRE confirms a mostly low knowledge of Javier Riera, while the POST shows high ratings and a significant perceived effect on the perception of immersive art.
- The experiential value is concentrated in the XR articulation, not as a "technological addition", but as a condition that reconfigures the spectator-work relationship. The most significant element for the majority was the experience with XR glasses (11/20), and 95% perceived a total or partial innovative art-technology connection.
- The technical-methodological framework conditions aesthetics and therefore must appear as part of the artistic method. The choice of Meta Quest 3 in *standalone*, the need for optimization, and the configuration in three sets/scenes in *Unreal Engine 5.5* are part of the ontology of the hybrid work (they are not mere instrumental details).

From a broader perspective, the results of this first phase allow us to consider the VAP project as a methodological contribution to the field of artistic research in visual culture. The integration of Mixed Reality not only expands the formal possibilities of the art installation, but also introduces a framework in which technical, spatial and perceptual decisions are intertwined from the beginning of the creative process. This approach is especially relevant in a context in which contemporary artistic practices tend to go beyond the traditional categories of object, medium and support.

The case study based on the work of Javier Riera demonstrates that the incorporation of XR can be carried out without diluting the conceptual logic of the artist, as long as technology is used as a tool for analysis and expansion, and not as a substitute for material experience. The physical piece maintains its role as a perceptual and symbolic anchor, while the virtual layer introduces a space for experimentation that expands the experience without annulling its situated and bodily dimension.

Likewise, the project opens up relevant lines of reflection for other areas, such as cultural mediation, art education or the design of hybrid exhibitions. The possibility of conceiving installations that integrate physical and virtual components from their origin poses new forms of access to the aesthetic experience, potentially adaptable to different contexts and audiences. In this sense, VAP is not presented as a closed model, but as an open and transferable methodology.

As future lines, the extension of the empirical study through more detailed qualitative instruments is proposed, as well as the exploration of new forms of interaction and integration of artificial intelligence in XR environments. This research will allow us to delve into the role of Mixed Reality as a creative environment and consolidate its contribution to the redefinition of the artistic installation in the digital age.

From this phase onwards, the following iterations should: (a) expand the qualitative register (e.g., brief interviews or codable open-ended questions), (b) incorporate presence/attention metrics if the cognitive-perceptual axis is to be strengthened, and (c) delve into the translation materiality–PBR (transparency/reflection/refraction) as the central axis of continuity between the real piece and its virtual extension.

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