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GENERAL ARTICLE

Gardien du Temple

An Interactive Installation Involving Poetry, Performance and Spatial Augmented Reality

PANAGIOTIS-ALEXANDROS BOKARIS, MICHELE GOUIFFÈS, VÉRONIQUE CAYE, JEAN-MARC CHOMAZ AND **CHRISTIAN JACQUEMIN**

ABSTRACT

Gardien du Temple is an interactive installation where the concealment or revelation of poems and images is achieved through diminished reality, a new approach to augmented reality using a projector-camera system. By capturing the environment with a camera and canceling parts of the scene by reprojecting inverted images, *Gardien du Temple* questions the control of our perception, of what is present or not. It reveals new perspectives for installations and performing arts aiming at erasing parts of the physical space.

Involving Adonis's poems, video and diminished reality, the art and science creation *Gardien du Temple* is both an installation and a performance on absence and presence, concealment and revelation. By motions and actions, the public or the performers hide or expose "signs" (written or spoken words, images, sounds or bodies) through spatial augmented reality techniques and interaction devices (Fig. 1). This work engages the spectator in a virtual space, enacting a philosophical reflection on the revelation of a "hidden world" inspired by the book *Sufism and Surrealism* by Syrian poet Adonis (b. 1930) [1]. The idea was conceived after research in Algeria during an Institut Français scholarship.

The Algerian Civil War [2] pitted the Algerian government against various Islamist groups from 1991 to 2002. The prevailing climate of fear had the effect of diminishing freedom of expression. Artist Adel Abdessemed: "I was lucky to be born and grow in a young country, but the young people could not express themselves" [3]. Painter Kenza Bourenane, on the effect of diminished freedom of expression on the art sector, stated: "Some artistic forms (literature, poetry, painting . . .) considered as subversive (because having a divergent political or religious vision) became hidden" [4].

Gardien du Temple is an invitation to view this "hidden world," including some Arabic poetries "hidden" in Algeria during this conflict. In this installation/performance, the actions of the public or dancers reveal or hide visually or acoustically the words of the famous poet Adonis in a space inspired by the Mausoleum of Sidi Abderrahmane in Algiers. The illusion is produced by augmented (and diminished) reality, interaction, projections, sound and dance.

The team behind *Gardien du Temple* comprises one artist (and her artistic team) and four scientists simultaneously involved in the artistic and technical writing. The artist, theater director and filmmaker Caye, has been developing hybrid and experimental performances through visual and sound research based on creative and poetic use of digital technologies. Using augmented reality, her performances question the relation between the video, the presence of the actor and the audience. For example, she has made performances without actors (*Silenzio*, *Genius Loci*) in which a sensory work (augmented reality, spatial sound) creates the illusion of their presence. In these hybrid works, she invites the spectator to discover another world, beyond reality. Through stories of revelations, apparitions and disappearance, she summons the hidden meanings and mysteries of the world. *Gardien du Temple* continues this research on revelation of the "hidden world" by provoking viewers' perceptual disorders, erasing "signs" (words or bodies) and revealing them in set design or installation. The artistic team was composed of musician Frédéric Minière, performer Ashtar Muallem and set designer Pascale Stih.

On the scientific side, computer science researchers Bokaris (in the context of his PhD [5]), Gouiffès and Jacquemin, together with fluid mechanics physicist Chomaz, developed new techniques in spatial augmented reality (SAR) for

Panagiotis-Alexandros Bokaris (computer scientist), LIMSI-CNRS, Université Paris Sud, Université Paris Saclay, France. Email: bokarisp@gmail.com.

Michele Gouiffès (computer scientist), LIMSI-CNRS, Université Paris Sud, Université Paris Saclay, France. Email: gouiffes@limsi.fr. Web: https://perso.limsi.fr/gouiffes.

Véronique Caye (theater director, filmmaker), Laboratoire Victor Vérité, Paris, France. Email: vcaye@wanadoo.fr. Web: www.victorverite.com.

Jean-Marc Chomaz (physicist), LadHyX, CNRS-Ecole Polytechnique, Université Paris Saclay, France. Email: jmchomaz@gmail.com.

Christian Jacquemin (computer scientist), LIMSI-CNRS, Université Paris Sud, Université Paris Saclay, France. Email: jacquemin@limsi.fr.

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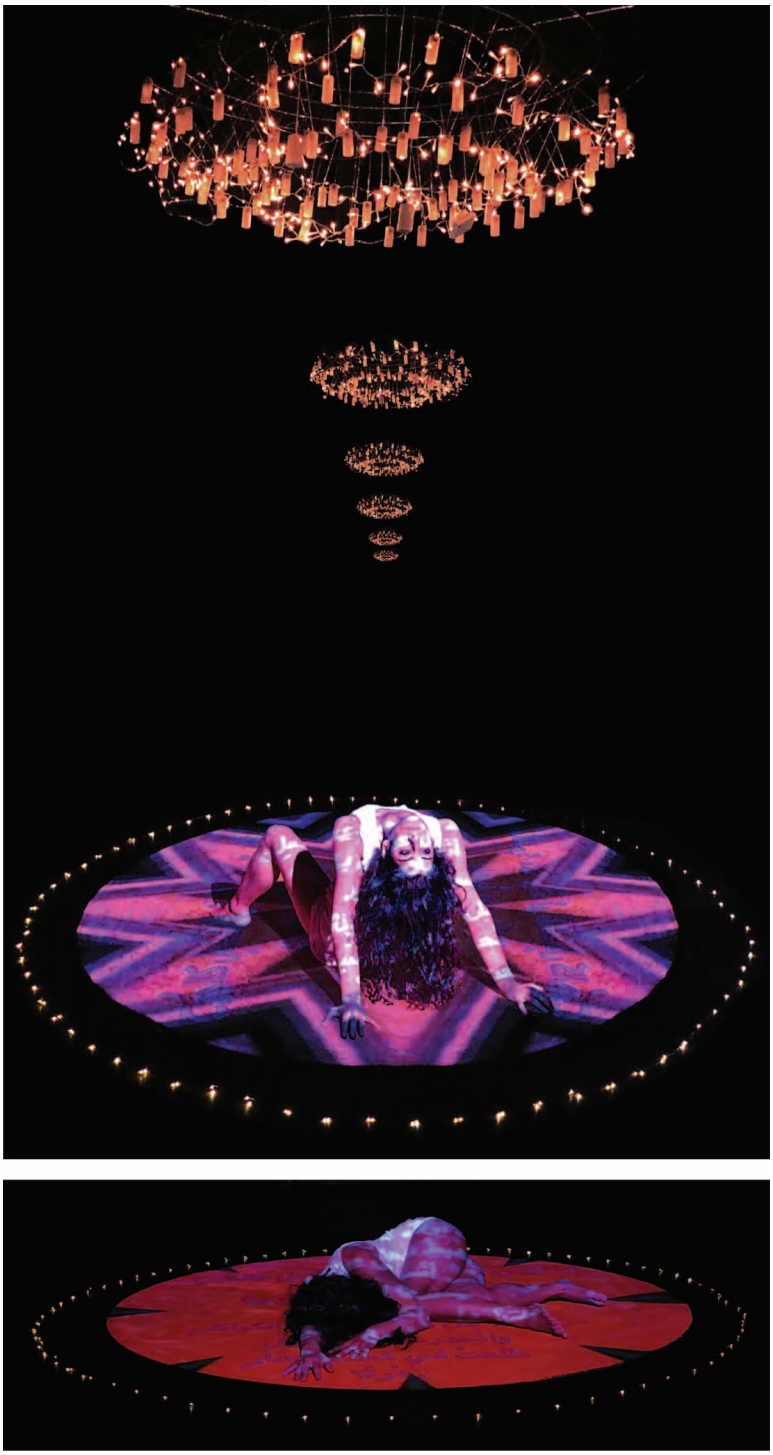

Fig. 1. *Gardien du Temple* installation performance. The contortionist reveals the Adonis poem on her skin as she dances on the augmented carpet. (Photo © Véronique Caye)

concealment and fluid experiments for revelation. Using projector-camera systems (ProCams), SAR techniques tend to project virtual content on the real world. The problem addressed here is the artificial camouflage of surfaces by projections, which required expertise in colorimetry, imaging and physics.

REVELATION AND CONCEALMENT IN ART AND SCIENCE

Virtual reality has been used in art and entertainment for redesigning the space around us, our interactions and our perceptions. Its architecture is deeply inspired by previous genres such as Renaissance painting (for its sense of space) and perspective or nineteenth-century panoramas (for immersion) [6]. Digital augmentation has been additive [7]. Interaction and narration have led to increased embodied presence in these environments, under the influence of game culture, by combining spatiality and interactive navigation or even teleportation [8].

Our approach to this technology differs: Instead of revealing the unseen, we subtly hide subversive words, revealed only through exploration of the space.

The concealment technique used in *Gardien du Temple* is color compensation: the video projection on a surface of a color image that is the opposite of the image of the color surface. The combination of the color of the surface and the opposite color is expected to deceive the viewers by making them perceive a neutral uniform surface. If the installation reveals hidden words on a dancer's skin or the blank book placed under the video beam, it is because the color-compensating video is projected on a surface (the skin or page) not that for which it is made (a carpet with a painted poem). Minomo et al. used a similar idea in an installation in which hiding one of two complementary beams revealed a colorful image [9]. By using a technique outside of its normal context, producing an opposing effect (revelation instead of concealment), *Gardien du Temple* turns color compensation into message revelation. Bourriaud analyzes such practice, called *détournement* and identified as a political act by Debord, as a mode of postproduction through reappropriation in contemporary art: "Artists today practice postproduction as a neutral, zero-sum process, whereas the Situationists aimed to corrupt the value of the diverted work" [10].

Yun et al. [11] present the basics of the technique for object concealment and its possible application in art. Based not on a ProCam system but on the transformation of video-surveillance images, *On va tous y passer* by Projet EVA [12] isolates an individual from their social environment by concealing the human presence around them. Many examples of political exploitation of concealment can be found in recent history, from the deletion of

undesirable associates in images to hidden cameras and microphones used to capture military or political information. Diminished reals by hiding built elements in a landscape. Mark Skwarek's *Augmented Reality Korean Unification Project* aims at hiding the Korean Demilitarized Zone between the two countries and restoring the landscape as it was when Korea was united [13]. The same artist has created a similar app involving the wall between Israel and Palestine [14]. Gershon, Kapralos and Mann reveal intrusive and hidden video-surveillance cameras through the *Surveilluminescent Wand* [15], using augmented reality for similar political and social purposes through revelation instead of concealment.

Revelation and concealment in art do not necessarily rely on digital media. In architecture, art installations and design, many surfaces or devices allow concealment of the onlooker or physical elements. *Mashrabiyah* [16] are used by artist Sousan Luqman to highlight such devices' role in control and observation socially and metaphorically in political life as well [17]. Wrapping, whatever its scale, from the most gigantic by Christo and Jeanne-Claude [18] to small prescription pill bottles by Sher Fick [19], is another art of concealment, which changes the symbolic role and value of the objects without significantly modifying their shape.

INSTALLATION AND PERFORMANCE

Gardien du Temple is an interactive installation consisting of a double video-projection using methods of augmented (or "diminished") reality and a sound device. Figure 2 illustrates the design of the room, where two elements are central: a free and symbolic "reconstruction" of the Mausoleum of Sidi Abderrahmane in Algiers and the revelation of Adonis's poem "Mon corps est mon pays" (My Body Is My Country).

Installation Display at CURIOSITas Festival

The grand salon of the castle of Gif-sur-Yvette was transformed to receive *Gardien du Temple* during the art-science festival CURIOSITas 2015 (Fig. 2). We designed the installation to underline the room's intrinsic attractive features. The room was emptied of its furniture and lit only by fairy lights in the chandelier in order to highlight its presence while reducing the global light intensity of the room. The light emitted by the projectors was strong enough to reveal the room's features without affecting the installation. The grand salon was thus transformed to provide the visitors with a "free and symbolic reconstruction" of the Mausoleum Sidi Abderrahmane in Algiers. This mausoleum, built for the patron saint of the city, is very popular in Algiers. Based on a mixture of popular cultures, it is mostly frequented by women [20ity through concealment can be used for political purpose]. They come for discussion, healing and peace and to read poetry in secret.

Our installation/performance is inspired by this place. The design and ornamentation of *Gardien du Temple* evoke its architecture: the ceiling lights reflected to infinity in the mirrors, pictures and videos shot there. The sound of the installation—female voices in French and Arabic—and the female interpretation of the performance are influenced by the atmosphere of the mausoleum.

The building's symbolism was manifest in the installation, where hidden words could be revealed through silhouette-based interaction. These words are excerpts of "Mon corps est mon pays."

Hidden Poem

Adonis is one of the greatest poets of the Arabic language [21]. Considered several times for the Nobel Prize, he works for freedom, claiming "the other" to be fundamental for the construction of oneself. "Mon corps est mon pays" is an invitation to put one's individuality, rather than any dogma, at the center of one's existence.

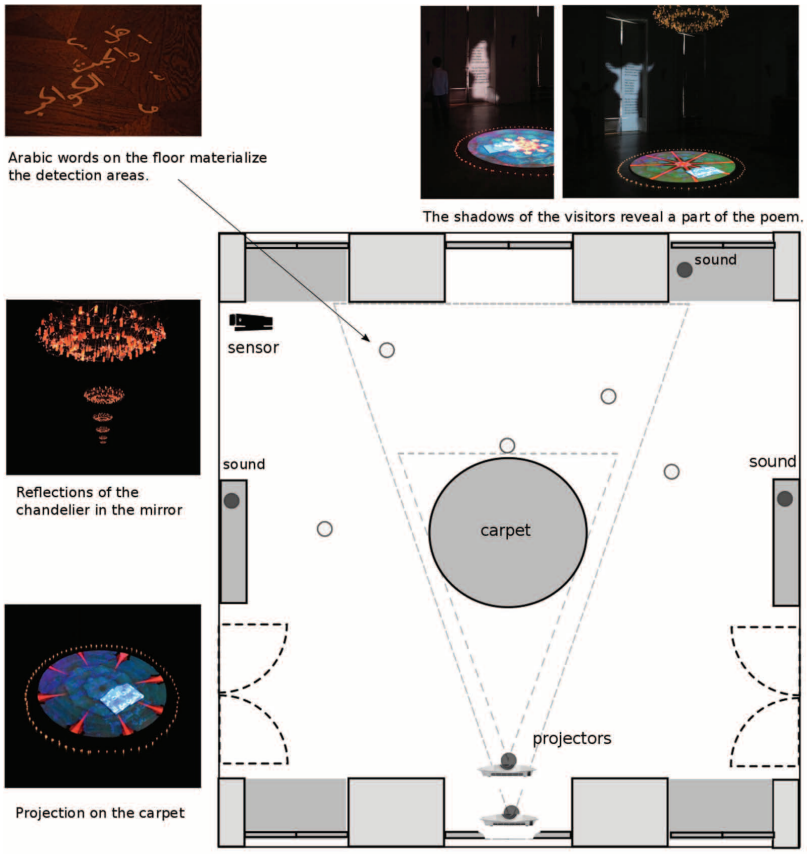

Fig. 2. Plan of the grand salon of the castle of Gif-sur-Yvette, with the main features of the *Gardien du Temple* installation: a Kinect sensor that detects the presence of the visitors in five locations marked on the floor with Arabic letters (represented here with gray circles), a carpet with diminished reality and a blank book to reveal the hidden poem, a chandelier above the carpet, two video projectors (one for the wall and one for the carpet). (© Michèle Gouiffès)

Fig. 3. Images extracted from the kaleidoscope video projected on the carpet (see Color Plate A for the compensated images). (Photos © Véronique Caye)

Tu m'as posé une question?
Meurs d'abord ou flambe telle une blessure,
Descends dans mes cendres et demande . . .
Tu me demandes quel est mon pays?
Mon corps est mon pays.

In his poem, far from fanaticism and frontiers, Adonis invites us to free ourselves from any systems and commitments, to become free individuals in the invention of a new country, the "body" continent.

In *Sufism and Surrealism,* Adonis develops the idea of an "invisible and hidden world" whose knowledge allows release of unconscious or unknown forces. The understanding of what is "hidden and secret" can be revealed only through a kind of "initiatory journey." In a certain way, one must struggle to earn the revelation of the meaning.

Similarly, in the installation, inspired by a symbolic reconstruction of the mausoleum, images, sound, texts and poems are deliberately hidden and their revelation are the spectator's own initiative, through their observation of the installation and other visitors' interactions and through their motion in the room.

Visitors enter the grand salon, which seems empty at first sight, simply furnished with a luminous carpet. One discovers, in a hypnotic soundscape, a video—projected onto the carpet—showing the mausoleum ceiling treated in a kaleidoscopic way (Fig. 3), merely suggesting without exhibiting it. On the carpet, an Adonis poetry fragment is painted in Arabic but is concealed from the visitor through a diminished reality technique (encoding of inverse colors inside the video). The fragments are revealed on the book, which displays the inverted colors used to conceal the poem on the carpet (Fig. 4). The visitors are invited to move the book around inside the projector beam so as to read the whole text.

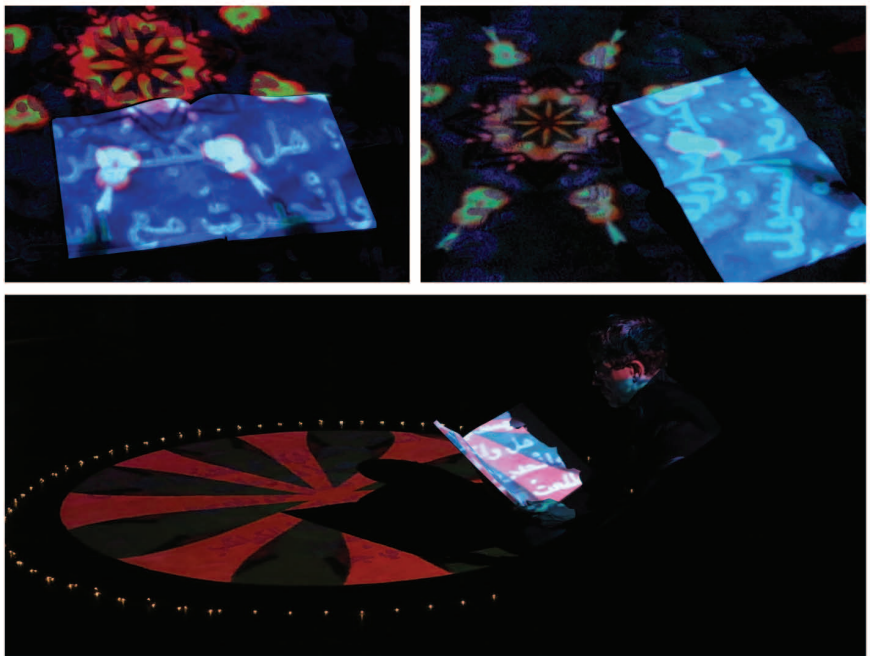

Fig. 4. A video projected onto the carpet shows the Mausoleum of Sidi Abderrahmane ceiling treated in a kaleidoscopic way. A fragment of Adonis's poem appears on a white book. (Photos © Véronique Caye)

This concealment and revelation illusion derives from research by Bokaris [22], which led to the following procedure. First, instead of projecting the raw video of Fig. 3, each frame's colors and geometry are corrected in advance by the proposed method in order to appear as it would on a white screen. Consequently, colors, and the poem, are hidden. Since color results from the interaction be-

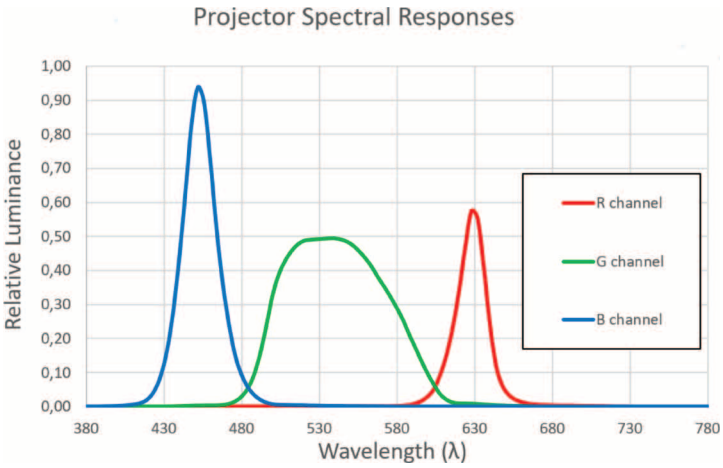

Fig. 5. Sensitivity curves of the D90 Nikon sensor. (© Michèle Gouiffès)

tween light, material and observer, removing the color of the material requires knowledge of the characteristics of the projector (the light), the surface reflectance (the material) and the camera (the observer).

First, the algorithm employs a calibration procedure to characterize each device photometrically and geometrically. The color calibration consists in estimating the color transformation caused by the spectral sensitivity curves of each camera channel RGB and reciprocally the three projector responses. These curves [23] (similar to Fig. 5) represent the relative quantity of energy emitted by the projector for each wavelength of the visible spectrum in the range 380–780 nm. The geometric calibration provides a relationship between the camera and the projector in order to produce the point-to-point correspondences between the two image planes. Structured light techniques have been employed for geometric calibration [24] where a set of binary images are projected and acquired by the system, as illustrated in Fig. 6. The temporal sequence of these binary patterns yields a unique code for each pixel, easily identified simultaneously in the projected and acquired images.

Consequently, colors and the poem are hidden. Once the system calibrates, the camouflage of the surface consists in concealing what is commonly called the color of the surface according to the ProCam model, that is, concealing the visual contribution of the reflectance in the perceived light reflected by the surface. The spectral reflectance curve of a material gives each wavelength the percentage of the impinging light reflected by the material. Unlike the spectral responses of the devices, estimated only once during calibration, the reflectance depends on the scene content, which varies spatially and temporally. To resolve this issue, the relationship between reflectance curves and color values of multiple patches of uniform color has been learned off-line beforehand by the system. Color Plate A shows a few examples of color and geometry corrections.

Interaction

The installation is interactive. The spectator is invited to walk around the room, as one would in the Mausoleum, to reveal the hidden poem. A drone sound creates a cozy atmosphere that invites a stroll. If the spectator places the blank book on the carpet, the white page reveals the Adonis text in Arabic in colors complementary to the carpet (Fig. 4). If one walks toward the opposite wall, it may trigger the onset of the poem either in sound (voices in French and Arabic) or in writings emerging from the white "shadow" of the viewer.

The presence of visitors is detected in five preset locations (using a Kinect sensor) and evidenced on the floor by Arabic characters (see Fig. 2). Depending on the activated area, the detection triggers a soundtrack and/or visual effects. While one voice recites a part of the poem in Arabic, another voice chants phrases, and the sound of instruments resonates. The silhouette of the visitor is captured by the sensor, merged in real time with the text of the poem and projected on the wall before them, giving them the illusion of a light shadow revealing the meaning of the poem (Fig. 7). To read the entire poem, the viewer must traverse the whole room.

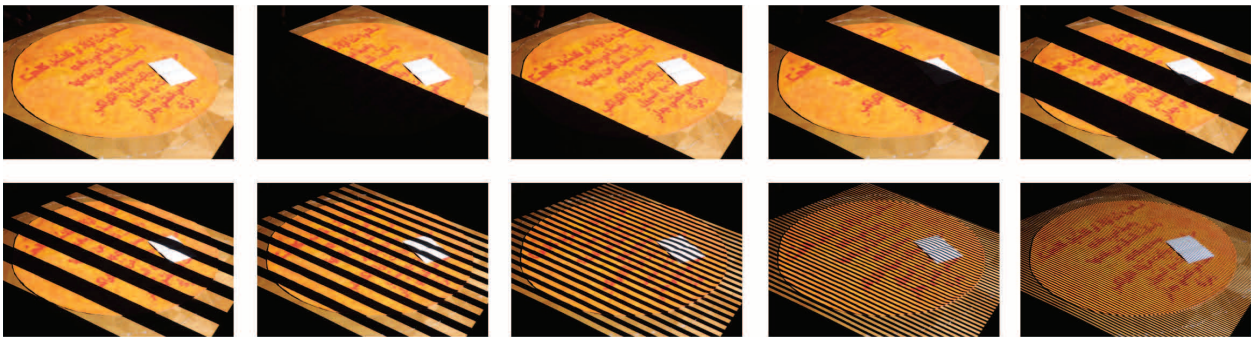

Fig. 6. Geometric calibration by structured light. 42 binary patterns projected on the surface of the carpet effect geometric correspondence between the projected video and the camera capture of the carpet. (© Michèle Gouiffès)

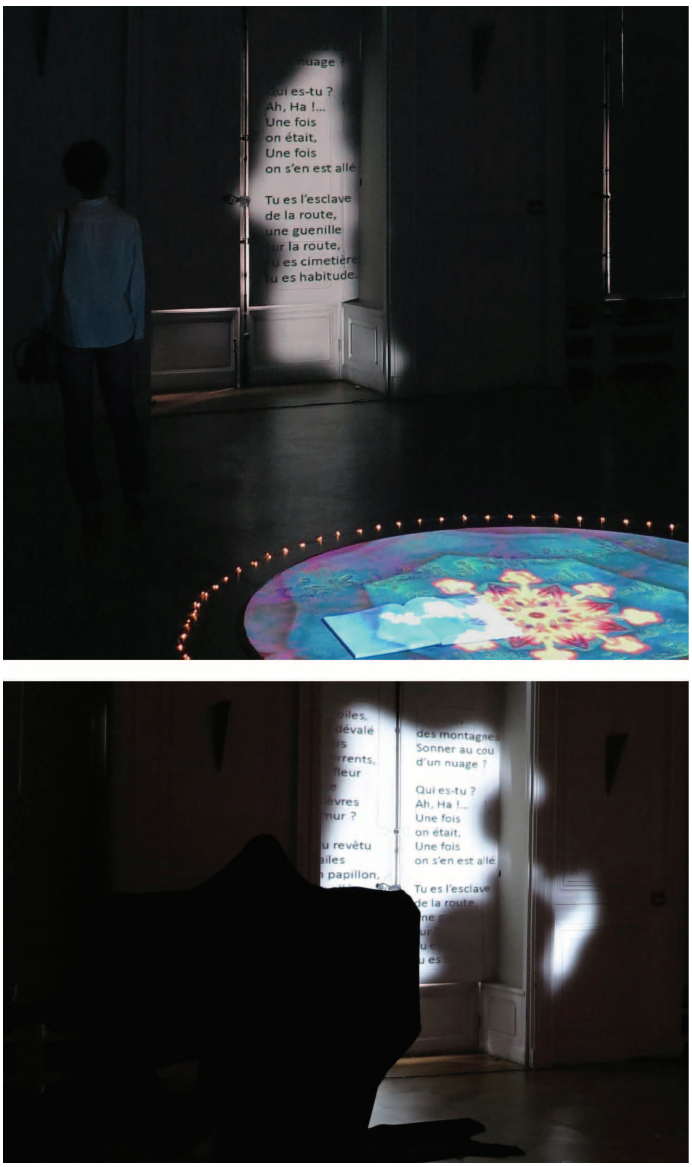

Fig. 7. The visitor can trigger visual effects and see their own digital white shadow on the wall, revealing the poem. The visitor has to move in front of the wall to reveal the whole text. (Photos © Véronique Caye)

Performance

The installation is not unequivocal and remains open to subjective readings and feelings. A performance was introduced (Fig. 1) at regular intervals during the display of the installation, offering visitors another perception of it. A woman covered with a 20-meter-long black veil wanders through the space, bending under the weight of the fabric. Her hidden face echoes the dual prohibitions of aniconism in Islam and the French law that forbids her to hide her face in public space. The woman starts to dance, gathering the veil from below, gradually seeking to extract herself from it. Her gestures and body movements trigger the audiovisual system. The woman, stressed in her movements, reveals by her ghostly presence the poem "Mon corps est mon pays" in the white shadow cast on the wall.

On the border of the carpet, the appearance of the hidden meaning becomes an invitation to get rid of the armor—represented by the black veil—to drop the mask, to reveal the face, to catch her breath. She enters the "kaleidoscope" carpet. The Adonis poem, in Arabic and French, put to music, resonates in the room.

The performer then reveals a light white dress under the black veil that itself reveals her body. The body, detached from any coercion, dances on the kaleidoscopically lit carpet, invents its poetry and reveals its flexibility. Amplifying the game of inversions and oppositions, dance unfolds into impossible contortions. On the one hand, the poem continues to resonate in the space with the sound. On the other hand, through diminished reality techniques, the performer embodies the poem overlaid on her body through the video-projection of the inverted colors. Like the book laid on the carpet, her body is virtually tattooed, and finally she unites with the fiber of the poem written on her skin.

CONCLUSION AND PERSPECTIVES

Gardien du Temple is the concrete achievement of an art-science project involving poetry, performance, spatial augmented reality and interaction. What is hidden and what is forgotten is revealed by the interaction of visitors through video projection, audio diffusion and their wandering in the space. The project was born from the dialogue between an artist and several scientists. On the one hand, the artistic point of view has guided scientific research on color compensation and has provided a real-world experimental context with its own constraints. On the other hand, the scientific advances and limitations have placed boundaries on the artistic research as they have stimulated creativity. The color compensation technique developed in the scientific research has been applied to planar and static surfaces but was designed to be extended easily to dynamic and nonplanar objects. This opens the door to new contributions in concealment and disclosure for living art, where the "objects" to be concealed would be the moving actors.

PARTNERS

Stage direction: Véronique Caye [25]
Scientific team: Panagiotis-Alexandros Bokaris, Jean-Marc Chomaz, Michèle Gouiffès, Kevin Heems, Christian Jacquemin, Xi W
Artistic team: Frédéric and Nathan Minière, Pascale Stih, Ashtar Muallem
Proofreading: Siokhan Kouassi
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25 Laboratoire Victor Vérité: www.victorverite.com.

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PANAGIOTIS-ALEXANDROS BOKARIS *is a scientist in augmented reality. He obtained his PhD in 2016 from the University of Paris-Saclay. In 2016 he joined L'Oréal R&I, where he currently leads a team on appearance digitalization and diagnostics.*

MICHÈLE GOUIFFÈS *has been an associate professor at University Paris-Saclay since 2006. She received her PhD in 2005 and does research in image processing, computer vision and art and science.*

VÉRONIQUE CAYE *is a theater director and filmmaker. She obtained a master's degree in arts at the University Paris VIII. She developed several hybrid and experimental performances and installations through visual research based on creative poetic use of digital technologies.*

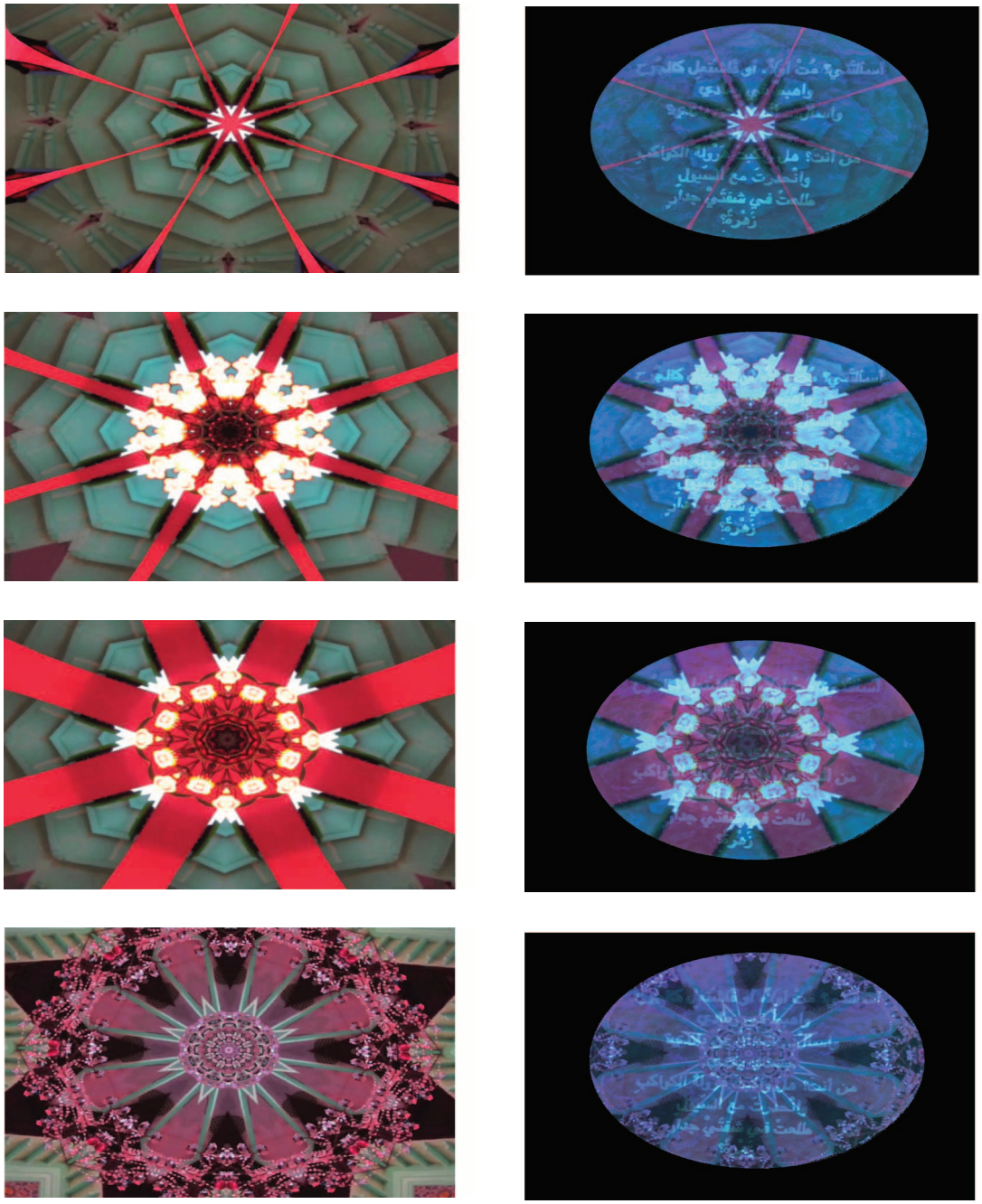
JEAN-MARC CHOMAZ *is an artist-physicist, director of research at CNRS, professor at Ecole Polytechnique, chair of the Laboratory of Excellence LaSIPS and bearer of the chair of Art and Sciences of Foundation Carasso.*

CHRISTIAN JACQUEMIN *was professor in computer science at University Paris-Sud until 2017. He worked in virtual and augmented reality and promoted art and science projects and events.*

COLOR PLATE A: ***GARDIEN DU TEMPLE*: AN INTERACTIVE INSTALLATION INVOLVING POETRY, PERFORMANCE AND SPATIAL AUGMENTED REALITY**

Original frames

Projected frames
(after color and geometric corrections)



Examples of color and geometry corrections applied to the video in order to conceal the writings on the carpet. (© Michèle Gouiffès) (See article in this issue by Panagiotis-Alexandros Bokaris et al.)