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Reproduction and Testing of Display Options for the Slide-Based Artwork *Slides de Cavalete* (1978–1979) by Ângelo de Sousa: An Experimental Study

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Abstract: *Slides de cavalete* | *Easel slides* (1978–1979) is a slide-based artwork by the Portuguese artist Ângelo de Sousa (1938–2011), composed of one-hundred colour slides. Each image was produced by capturing different proportions of red, green, and blue (RGB) lights to obtain colour gradations. The artwork was first presented in the exhibition *A Fotografia como Arte/A Arte como Fotografia* | *Photography as Art/Art as Photography* in 1979. Associated with this exhibition, documentary evidence was found during the present study providing specific instruction on how to display the artwork (possibly unknown until now). According to that documentation, the artist wanted the work to be projected on a canvas mounted in an easel with a 19th century semblance, using a slide projector. In the last two exhibitions, carried out in 2017, after the artist had passed, the work was displayed as a digital projection, without the previously mentioned sculptural components. It was considered that this deviation from the first presentation could have led to a misunderstanding of the work. Thus, an exhibition of this artwork was prepared in a room at the Library of Faculdade de Ciências e Tecnologia. This was built as an experimental laboratory, having as one of its important objectives to test the variability of the work projected with a slide projector and a digital projector, following the display setup defined by the artist. For four days, the visitors were shown the work displayed under these two distinct scenarios of presentation. The visitors were also asked to fill out a questionnaire, to capture their perception about the variance of the work. The data obtained in the questionnaire and during the exhibition reinforced the decision to expose *Slides de cavalete* using the original technology. The public preferred the quality and beauty of the image using the slide projector, highlighting as positive aspects more granularity and warmer hue as well as higher depth of the images. Additionally, the production process behind *Slides de cavalete* was studied, based on documentation discovered in the artist's archive and on reproductions, to enrich our perception of the work, in particular the complexity of creating the sfumato effects, and to understand the impact of changing the display technology. The results obtained made it possible to identify the main steps of making these slides, and this knowledge was shared with visitors in a workshop, integrated in this experimental laboratory.

Keywords: Ângelo de Sousa; Slides de cavalete (1978–1979); slide-based artworks; exhibition; display setup; slide projector; digital projector

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1. Introduction

1.1. Challenges of Exhibiting Slide-Based Artworks

Slide-based artworks can be classified as time-based media since they have duration as a dimension and are dependent on technology. Contrarily to "conventional" art, time-based media has no identified object that constitutes *per se* the artwork. In general terms, this type of works needs to be installed to be experienced and requires a display equipment to be observed [1]. With these characteristics, slide-based artworks are challenging for conservators. According to the conservator Tina Weidner [2], the main fragility of slide art relies on its media technologies dependence, raising issues regarding its long-term preservation and display. Colour slides are chromogenic reversal films, photographic materials composed of a polymer support (e.g., cellulose triacetate) and at least three superimposed emulsion layers made of cyan, magenta, and yellow dyes, respectively, dispersed in a proteinaceous matrix (gelatine) [3]. These are chemically unstable photographic materials, highly prone to fade under uncontrolled environmental conditions and/or when exposed to light. Over time, the different dyes fade at different rates, causing a shift in the original colour balance [3–8]. For this reason, the original slides should not be displayed due to the aggressive conditions to which they would be subjected to [4]. Thus, as explained by Weidner, the installation of this type of work is dependent on the capability to duplicate slides [2]. Exhibition copies can be produced by replicating the technology of the films (duplicates) or converted in another format, such as the digital one. Using the same technology allows to maintain the aesthetic content of the original images. However, since duplication slides (low-contrast films with very fine grain/very low film speed, to capture detail) were completely discontinued in 2010, alternatives had to be found to ensure the creation of accurate duplication sets [2]. Instead of analogue duplication, digital duplication can be considered as a solution. This implies digitizing the slides and flashing the digital file into a chromogenic reversal film [9]. Generating a digital intermediate might be advantageous as this can be more easily manipulated to conform to the currently available films. Nevertheless, when using a digital procedure, certain features of the original technology can be lost in the process. A digital image is created by light captured electronically and converted into a numeric representation, while a photographic image is captured in an emulsion layer made of gelatine and photosensitive materials [10]. However, it seems inevitable that, sooner or later, digitization will become part of the preservation and exhibition processes in slide-based artworks. Quoting Barbara Sommermeyer and Claartje van Haaften [11]: "On the assumption that digital technology will probably completely overtake analogue slide technology, we must continue to develop a conscious awareness of what will be lost in the process, in order to formulate precise decisions".

Slide-based artworks are not only threatened by the obsolescence of the exhibition copies, but also of the display equipment. Projectors are mass-produced equipment that can usually be replaced for an equivalent with discernible change [12]. Nevertheless, due to the obsolescence of the slide projectors and its spare parts, the permanence of the display equipment is dependent on its availability and on specialists with the knowledge on how to maintain and repair it [2]. Despite these difficulties, the replacement of the slide projector by a digital projector might change the landscape, and consequently, the experience of the artwork. As supported by Iwona Szmelter [13], specialist in conservation of contemporary art, the reception of a work is highly dependent on the way it is presented. The physical/sculptural effect, the sound of the slide projector mechanism, the transition effect between images, the appearance of the produced image, are some of the characteristics that can be affected by changing the original technology [11,14,15]. Quoting Weidner [16]: "Whilst artists foreground the experience of the apparatus of slide technology to a greater or lesser degree, the position of the slide projector on a pedestal and the sound it creates when the slides change is tightly interwoven with our experience of these works. Though we appreciate that the equipment associated with slide technology possesses a sculptural presence, this is often entirely unintended and is simply a consequence of using this technology. Nevertheless, the carousel slide projector has become an iconic object and

the distinction between the apparatus of 35 mm slide projection and a digital projection is therefore significant".

Considering the aforementioned issues implied in the presentation of a slide-based artwork (besides other constraints not referred to here, such as the exhibition budget), the originally used technology might be disregarded during the installation, and the significance of the artwork jeopardized. As stated by Weidner [2]: "How to negotiate the future of these works in cases where no satisfactory alternative means of display can be found is largely unknown territory." However, according to the same author [17], now is the time to compare the impact of shifting from analogue to digital technology, while both technologies still coexist. Since there are no universal solutions, each work must be regarded as unique when the time comes to plan the installation [18]. Display options for the slide-based artwork *Slides de cavalete* | *Easel slides* (1978–1979) by the Portuguese artist Ângelo de Sousa (1938–2011) were weighted and are presented in this paper.

1.2. Case Study: Slides de Cavalete | Easel Slides by Ângelo de Sousa

Ângelo de Sousa is a Portuguese contemporary artist, known for an experimentalism that enabled him to achieve exceptional originality. Interested in and informed by colour theories and perception, the artist made several works in which he explored the synthesis of colours as a means of expression. From the 1960s onwards, he favoured the use of the primary colours [19]. In 1978–1979 he produced *Slides de cavalete*, a diaporama composed of one hundred colour slides. Used to work with the subtractive synthesis in his drawings and paintings, the artist resorted to the additive synthesis by combining coloured lights [20]. *Slides de cavalete* begins with 8 slides with text that work as introductory slides. The introduction is followed by a series of 87 slides constructed with the additive synthesis. This set is composed of two parts: images with a triangle (Part I) and images with a rectangle (Part II), both shapes having the same proportion (Figure 1). The artist ended the work as he began it, with slides containing typed text [21]. The achieved result can be considered as one of the most prodigious photographic works by Ângelo de Sousa [22], and also as a noteworthy work in the Portuguese artistic art scene of the time.

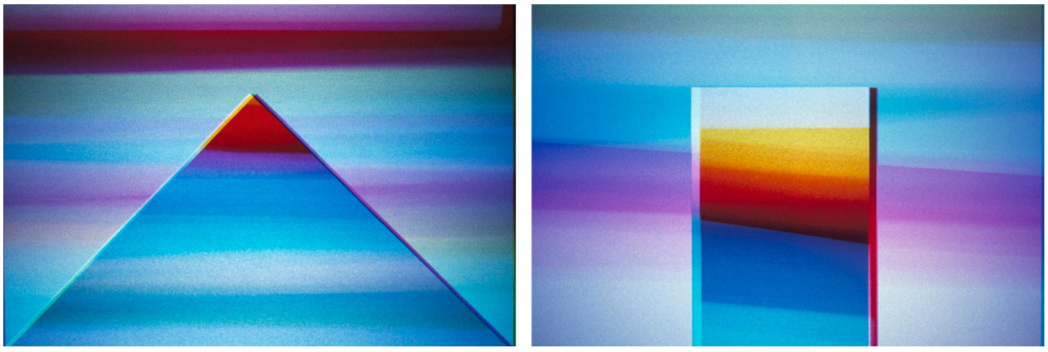

Figure 1. Ângelo de Sousa, Slides de cavalete (1978–1979), diaporama composed of one hundred 35 mm chromogenic reversal films with cellulose acetate base; **Left**: Example of a slide from Part I; **Right**: Example of a slide from Part II; Artist's collection.

Slides de cavalete was only presented in two exhibitions during the artists' lifetime, and four more exhibitions after his death. The work was shown for the first time in the itinerary exhibition *A Fotografia como Arte/A Arte como Fotografia* | *Photography as Art/Art as Photography* in 1979, curated by Floris Neusüss. The work was exhibited under the title *Slides de cavalete: Fotografias (slides) de algumas pinturas imaginadas e inexistentes (excepto nos próprios slides projectados)* | *Easel slides: photographs (slides) of some imagined and non-existent paintings (except in the projected slides themselves)*. [23]. The work was exhibited at Centro de Arte Contemporânea—Museu Soares dos Reis (Porto, Portugal) and at Fundação Calouste Gulbenkian (FCG) (Lisbon, Portugal). As described in a previous publication [21], the

artist presented the artwork by projecting the slides on the surface of a canvas placed over an easel with a 19th century semblance. This information was recorded in a letter left by the artist found at FCG's archive explaining the display setup, found within the framework of the present study and presented elsewhere [21]. *Slides de cavalete* was only re-exhibited almost ten years later, in *Fotoporto: Mês da Fotografia | Photoporto: Photography Month* (1988) at Casa de Serralves (Porto, Portugal). Unfortunately, it was not possible to determine in which manner the work was presented on that occasion [21]. For the exhibition *Encontros com as formas | Encounters with forms* (2014, first after the artist passed), held at Fundação EDP (Porto, Portugal) and curated by Sérgio Mah, the one hundred slides were digitized in high definition and the digitisations were sent to a company in London, in order to be printed with a film recorder in chromogenic reversal film. The duplicates were displayed in a small dark room to provide an ideal scenario for a solitary contemplation of the work [21]. In the exhibition *La couleur et le grain noir des choses | The colour and black grain of things* (2017), held at FCG (Paris, France) and curated by Jacinto Lageira, the digital copies produced for the exhibition in 2014 were presented through a digital projector, placed at the top of the entrance staircase. Likewise, in the most recent exhibition, *Potência e adversidade, Arte da América Latina nas colecções em Portugal | Power and adversity, Art from the Latin America in collections in Portugal*, held at Museu da Cidade (Lisbon, Portugal) and curated by Marta Mestre, similar options were undertaken. A DVD was made with three experimental films by Ângelo de Sousa, together with the work *Slides de cavalete*, to be presented in a digital projector as a slideshow in a dark room. Additionally, on the 7 July 2018, the work was presented in a one-day session organized by Alexandre Estrela, along with the work *Nobody Here* (2009) by Daniel Lopatin, within the framework of the *Jornadas Lúcidas 2—Oporto | Lucid Journeys 2—Oporto*, at Casa dos Marinheiros Mercantes (Lisbon, Portugal). Exhibition copies were produced following the same methodology and resorting to the same suppliers as for the exhibition *Encontros com as Formas*. The work was projected using a slide projector on 4 m wide screen in a large dark room [21].

Thus, after the artist's death, this work has been displayed following different setups and by using different projection technologies, according to curatorial choices. In the last exhibitions, it is possible to observe a deviation from the first presentation of the artwork, designed by the artist. Therefore, for a better understanding of the work and the impact of a shift in the original technology, its production process was analysed and reproduced based on detailed documentation found in the artist's archive as well as materials that were used to produce the colour effects. To test the variance of the work displayed with a slide projection and a digital projection, an experimental study was carried out in an exhibition room at the Faculdade de Ciências e Tecnologia (FCT NOVA)'s Library where the two display options were evaluated and compared.

2. Experimental

2.1. Reproducing Slides de Cavalete

During the conducted study, a file containing an extensive registration of the production of the work *Slides de cavalete* was found in the artists' archive. After thoroughly analysing this documentation, the process used to make *Slides de cavalete* started to be tested. Reproductions were carried out between 2014 and 2018 at FCT NOVA, within different courses from the bachelor and master in conservation and restoration. To do so, the following materials and equipment were used: (1) slide projector (Leica P150) where the red, green, and blue (RGB) filters (Rosco CalColor ™ Kit mounted with slide mountings) were placed, with a frosted glass positioned in front of the lens in order to reduce the light intensity; (2) two frosted glasses sustained vertically by using laboratory tweezers, and in between a black cardboard masking the background in order to expose the triangular shape (following the dimensions described by the artist); (3) photographic camera over a tripod. The equipment setup was arranged according to the documentation left by the artist. The first tests were carried out by using a digital camera (Nikon D700, with a Nikon lens AF-S Micro Nikkor 60 mm) using the multiple-exposure mode, to immediately assess

the obtained results. After controlling the process, one slide from the diaporama (slide 58) was selected and captured by using both digital and analogue cameras (Canon T90, with a Canon lens FD 50 mm). Despite the fact the original work had been captured in an Ektachrome 160T 125 ASA, since this type of films has been discontinued and considering the low variety of film types available nowadays, Fujichrome Provia 100F 100 ASA was used for the reproductions. The films were processed by a commercial laboratory, using E-6 chemistry.

2.2. Exhibition at FCT NOVA

An experimental study was carried out on the exhibition entitled *Slides de cavalete* in which the artwork was displayed according to two schemes: scenario A—a digital projection, and scenario B—a slide projection. The study was organized in an exhibition room (studio) at FCT NOVA's Library, between April 23rd and 27th 2018, according to the programme summarized in Table 1. This room was selected because of its dimensions and light, which allowed a private contemplation of the artwork, in an open space. During the first and third days of the exhibition, the artwork was displayed by using a digital projector, and on the second and fourth days, by using a conventional slide projector (Figure 2). In the first and last days of the exhibition, a hands-on workshop was offered with the intention of explaining the production process behind the artwork. Additionally, on the first day, three different seminars were held to present the artist, Ângelo de Sousa, to the public, as well as the artwork under study, its technology, and its exhibition history to the public. On the last day, a roundtable was organized aiming at bringing together connoisseurs on Ângelo de Sousa's photographic production.

Table 1. Schedule of the Experimental laboratory at FCT NOVA.

1st Day	2nd Day		3rd Day	4th Day
Digital Projector	**Slide Projector**		**Digital Projector**	**Slide Projector**
Opening Seminars Workshop Exhibition	Exhibition	**Closed**	Exhibition	Round-table Workshop Exhibition

Figure 2. Views of the work *Slides de cavalete* (1978–1979) presented at *Sala Estúdio* (Library from Faculdade de Ciências e Tecnologia (FCT NOVA)). **Left**: digital projection; **Right**: slide projection.

Slides de cavalete was continuously presented (in loop) from 9 am to 6 pm, for four days. Each slide was projected for nine seconds before changing to the next one. Since no

references were left by the artist considering the projection time, testing was carried out. Based on the testing, the selected time seemed appropriate to fully appreciate each image. Considering the passage between slides, about 14 min were necessary to experience the whole work.

The work was projected onto a white canvas mounted on an easel, following its first presentation in 1979. As defined by the artist, the canvas should be such as that used for painting, rectangular (120 × 90 cm, or larger within the same proportions), widthwise. The canvas used to project the work, brought from Ângelo de Sousa′s archive, was 128 × 96 cm and coated with a white preparation made by the artist or his assistant. The chosen easel had a 19th century look with a hand crank, as described by the artist in the letter found at the FCG′s archive [21].

In both digital and slide projections, the work was presented in the same room with the same conditions. A plan of the room and disposition of the equipment is presented in Figure 3. The illumination of the room was only provided by natural light coming from the entrance. To offer additional information to the public about the artwork, a scheme by Ângelo Sousa detailing the creative set up for the execution of the slides was drawn in large scale, on one of the walls (Figure 4), and several objects used by the artist in the creation of the slides were also exhibited. These were presented inside a showcase at the back of the room together with other support documentation. The objects on display were: (i) the file detailing how to produce the slides from *Slides de cavalete*; (ii) the RGB filters used to produce the work and other filters found in the artists' archive; (iii) some experimental slides produced within the experimentation process underlying the production of the artwork; (iv) the catalogue from the exhibition *A Fotografia como Arte/A Arte como Fotografia* (1979); (v) a *facsimile* of the letter found at the FCG′s archive, explaining how the artist wished to display his work in the 1979 exhibition. Moreover, a brochure containing information mainly associated with the production process was made available to the visitors.

Regarding scenario A, a Panasonic PT-AE4000 was used to project high-quality digital images of the work. Three different digital projectors were tested: Panasonic PT-AE4000 was the one leading to better results, and consequently was selected for the exhibition. The original slides had been previously digitized, using a Hasselblad drum scanner. The digital images obtained have the following characteristics: TIFF format, 64 MB, 300 dpi, 4096 × 2732 pixels, 48 bits depth, Adobe RGB 1998 colour profile. To project the images during the exhibition, a MPEG video had to be made and no profiling was assigned to the digital projector. Regarding scenario B, a set of exhibition copies was produced to be displayed in the slide projector. Since it was impossible to create analogue duplicates, the same digitisations were printed out with a film recorder on a chromogenic reversal film. The slides were projected with a Kodak Ektalite 2000 slide projector.

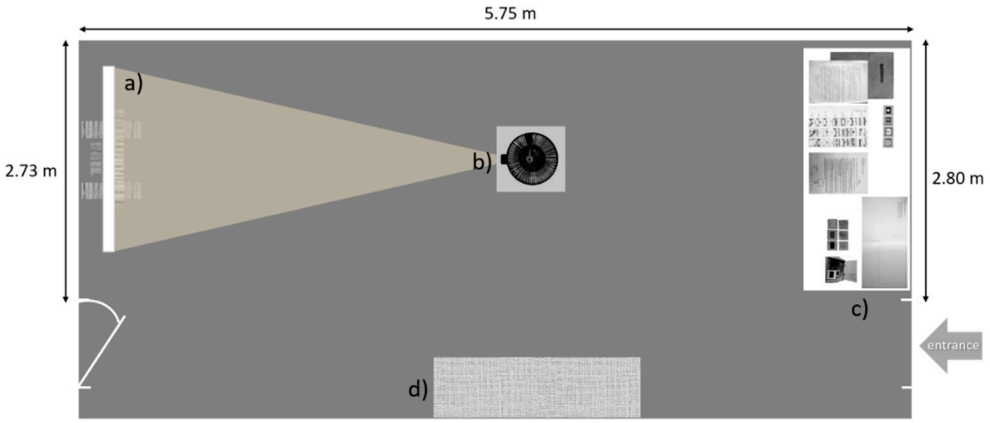

Figure 3. Scheme of the exhibition setup (top view); (**a**) canvas over an easel; (**b**) projector over a stand; (**c**) showcase; (**d**) bench.

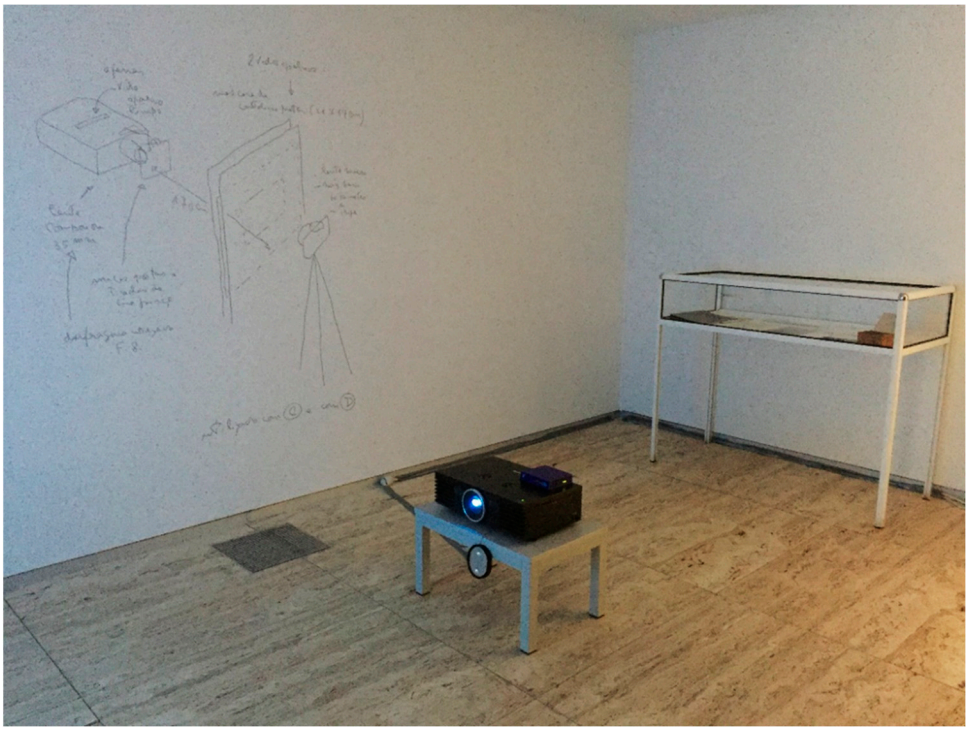

Figure 4. View of the exhibition space showing the reproduction of a diagrammatic projection scheme by Ângelo de Sousa on the wall and in the showcase.

For the collection of information on the exhibition, an ad hoc questionnaire was prepared. The questionnaire was composed of a total of nine questions, regarding: (i) characterization of the participants (genre, nationality, age range, level of education, training area, profession, and frequency attending exhibitions); (ii) attendance or not attendance at the workshop about the production process of *Slides de cavalete*; (iii) perception of the aesthetic quality of the artwork itself; (iv) perception of the quality of the projection. For the two last items (iii and iv), a Likert-type scale with four points was applied, respectively, as follows: (i) excellent quality, very good quality, mean quality, reduced quality, and (ii) excellent ambience, very good ambience, mean ambience, bad ambience. Regarding the research design, a 2×2 mixed factorial design was used with a within-subject factor (repeated measures) and a between-group factor. As mentioned above, the within-subject factor was the "projection technology" with two levels: "slide projection" and "digital projection." The between-group factor was "attended the workshop" and "did not attend the workshop." Eight dependent variables were considered, namely four variables for the perception of the aesthetic quality of the artwork (colour brightness, colour beauty, visual harmony, and chromatic quality), and four variables for the perception of the projection quality (rhythm of the projection, sound of the projection, beauty of the projection, harmony between work and projection).

After the observation of the artwork, the same questionnaire with the same questions was distributed to visitors, who immediately filled out the form. To avoid influencing the respondents, the visitors were not in possession of additional information concerning the aims of the study. Moreover, the questionnaires were anonymous. This approach was followed to ensure the homogeneity of the data and the reliability of the results. The obtained answers were analysed using Wizard software.

3. Results and Discussion

3.1. Production Process of Slides de Cavalete

On the first page of the file recording the production process of the work *Slides de cavalete*, dated from 1988 and signed, the artist briefly describes the process and the

materials he used. He also explains that preliminary tests were necessary to master issues of filtering, exposure times, film characteristics, etc. In the same file, more information could be found, such as: (i) typed texts (that appear at the beginning and at the end of the work); (ii) hypotheses for the script (not the final script); (iii) information about the conducted tests (carried out between 11th February and 4th March 1979) and some examples of the resulting slides; (iv) schemes and notes mentioning the equipment needed to produce the slides and their precise positions; (v) shape proportion; and (vi) sketches explaining how to obtain the desired luminous gradations. Based on this documentation, it can be concluded that *Slides de cavalete* resulted from extensive planning and experimentation. In the turn of the 1970s, Ângelo de Sousa would have to wait several days or weeks for the film to be processed abroad before assessing the obtained results. The images were therefore only existent in his head and sketches. This idea was made clear in the title resorted by the artist for the first presentation of the artwork, previously mentioned. Considering the test slides that remain in his archive (about 260 slides), it is also possible to conclude that other compositions were tested, with different shapes and contrasts. Thus, the slideshow would have been the outcome of a selection of images chosen from the obtained results.

After analysing the documentation and materials left by the Ângelo de Sousa, the reproduction of the production process was carried out to achieve an understanding of the artwork as complete as possible. Although the layout of the equipment was arranged according to the documentation left by the artist, some adaptations had to be done due to the specificities of the apparatuses and materials at use (distance between equipment, exposure times, lens aperture, etc.), which were different from those used by the artist (Figure 5). The obtained reproductions for slide 58 (both digital and analogue) can be seen in Figure 6. The first tests were carried out by using a digital camera (multiple-exposure mode), to immediately assess the obtained results. Interestingly, in the documentation left by the artist, he refers that: "by using other resources-electronic, a computer-I could have obtained results, not only faster, but also with other ambitions with regard to the details' treatment." After mastering the technique, the process was repeated with an analogue photographic camera. However, the results obtained with this camera were not so satisfactory since the images were obscured. This may be due to technical problems related to the photographic camera (exposure time) or to the chromogenic reversal film (inadequate film type, incorrect development, etc.).

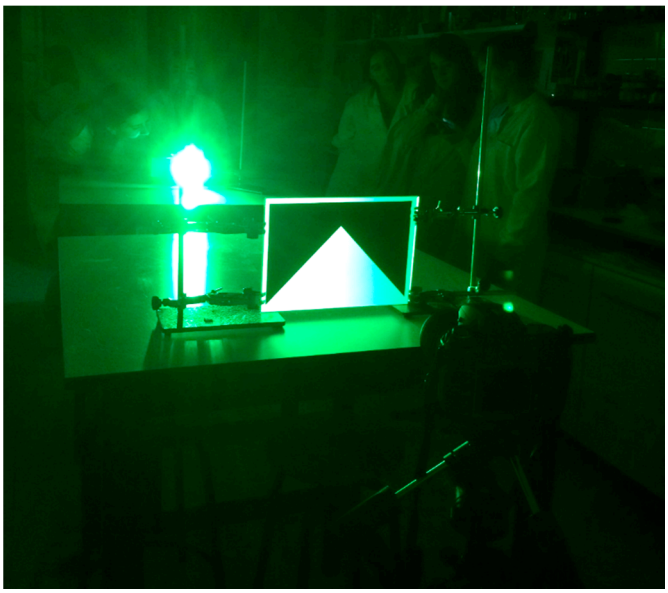

Figure 5. Reproduction process of the work *Slides de cavalete* (1978–1979).

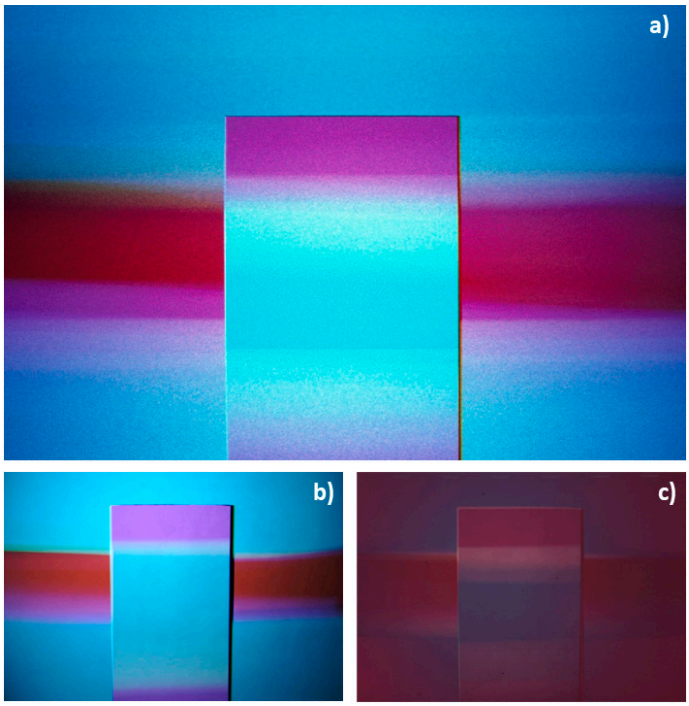

Figure 6. Slide 58 from the work *Slides de cavalete* (1978–1979); (**a**) original image, (**b**) reproduction obtained with the digital photographic camera, (**c**) reproduction obtained with the analogue photographic camera.

Nevertheless, this practical experiment was very helpful in recognizing certain subtleties required while obtaining colour gradations, which were not explicit in the documentation left by the artist. The reproductions also enabled to understand the complexity of the images composing the work, both in terms of its concept and execution process. It should be emphasised that, contrarily to Ângelo de Sousa who worked alone (as far as it is known), the reproduced images were obtained with the participation of several students managing the different tasks implied in the process (shooting, changing filters, changing masks, applying secondary masks to produce light gradations, etc.).

Based on the research that has been conducted, it is now possible to come forward with a proposition on how the work *Slides de cavalete* was produced, described below, and outlined in Figure 7:

- A slide projector was used to project R, G, and B lights, on two frosted glass panes (on a roughly A4 format). To do so, filters with these colours, as primary as possible, were placed inside slide mountings, and projected, one at a time, during the exposure;
- Filters (e.g., frosted glass with and/or without painted grids) were used to reduce the amount of light reaching the glass panes, and make it possible to increase the exposure time;
- Cardboard masks (triangular or rectangular) were fixed between the glass panes to alternately block the light in the shape or in the background and expose the two areas, separately;
- Secondary masks were used to block the light in selected areas and to obtain colour gradations, usually very subtle, as if applying the technique of "sfumato." These could be opaque objects such as hands or cardboards, slowly moving in front of the lights during the exposure time;
- A photographic camera was placed at a certain distance behind the glass to successively capture multiple exposures of the R, G, and B lights. Three exposures for the shape and three for the background are needed. Coloured lights were captured on chromogenic reversal film, each frame/slide being composed of six exposures.

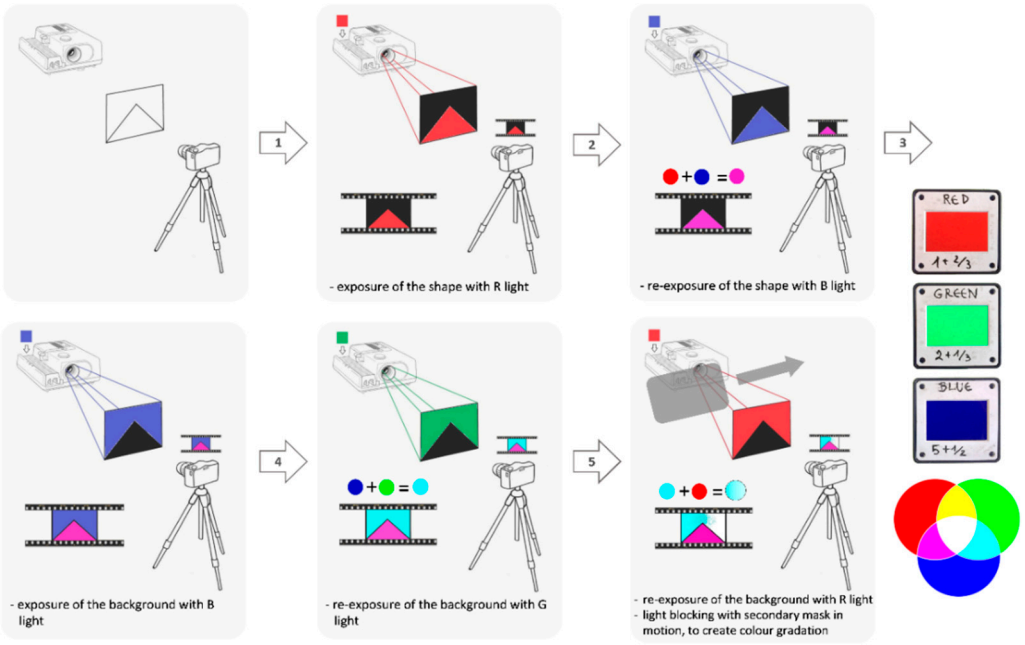

Figure 7. Illustrative scheme of the production process of *Slides de cavalete* (1978–1979).

For example, by successively projecting each coloured light for the same proportion of time, through multiple exposures in the same frame, the pure white colour could be obtained. If the artist played with different proportions of the three filters, which he controlled by using opaque secondary masks to reduce light exposure in certain areas, he would obtain different tones and gradations. By complying to the principle of additive mixing, and according to his own words, he would be able to predict the result of the sum of the primary colours [20]. The production process was described by him as very simple and quite predictable, but with a certain degree of randomness, which he also controlled through experimentation. In our experiments, the colour gradations were obtained by moving cardboards, in front of the glass panes during the exposure time, usually very slowly. Figure 8 shows the secondary masks used for each one of the coloured filters (RGB) for the background and shape to obtain the colour gradations and reproduce the selected slide.

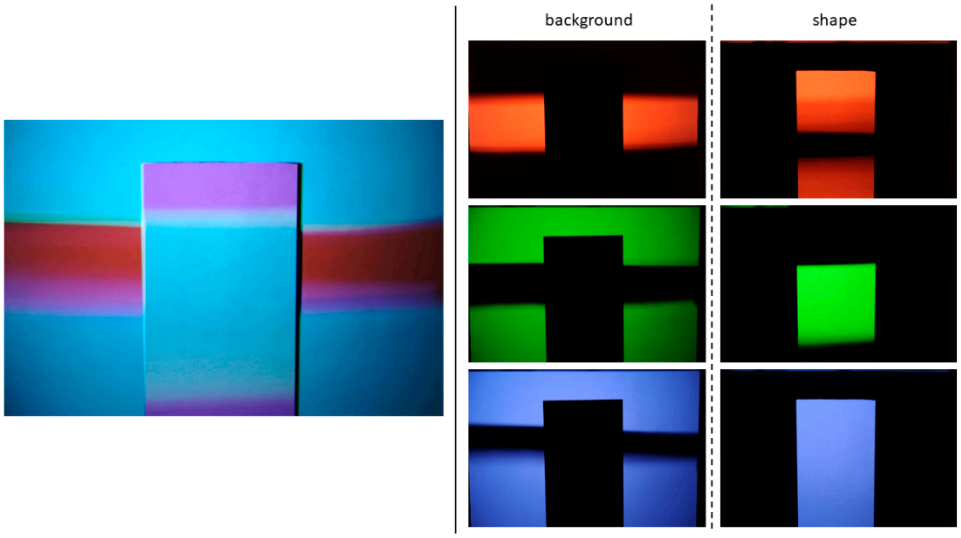

Figure 8. Secondary masks used to block the RGB lights in selected areas and create the colour gradations necessary to reproduce the slide 58 from the work *Slides de cavalete* (1978–1979).

It should be highlighted that, besides being an important piece for the display of the artwork, the slide projector was essential for its production.

3.2. Display Testing at FCT NOVA

The two scenarios of this exhibition were supposed to be built with the exact same characteristics. However, some technical constraints have arisen during the process of installing the exhibition, making this goal difficult to achieve. Nevertheless, the variations described below were considered not to affect the results of the study.

According to an investigation conducted by Haida Liang, Pip Laurenson, and David Saunders [24], in a partnership between the Tate and the National Gallery (London, UK), digital duplication of slide-based artworks has led to accurate copies. As stated by Tina Weidner [25], this solution allows for the maintenance of the original physical support and it can be considered a good alternative to analogue duplication. Unfortunately, the obtained colours of the exhibition set were not very accurate: the copies presented less vivid and darker colours than the original artwork. Due to a lack of resources and time, these slides were presented at the exhibition. Contrarily to what might be supposed, colour accuracy was not easier to achieve with the digital projection; it was difficult to obtain a good reproduction of all the colours in the same image within the several modes and adjustments tested. If good profiling and light intensity adjustments would have been assigned to the projector, a better dynamic range and rendering of colours would have probably been achieved. However, no technicians with this type of knowledge were available. Since the carousel of the projector could only hold eighty slides, a selection of the slides to be projected had to be made (Removed slides: 5, 8, 14, 17, 19, 32, 36, 40, 41, 46, 51, 53, 57, 59, 64, 69, 76, 91, 93, and 95). Although the artwork should be presented in a suitable carousel, as it was unavailable and deemed not to affect the result of the experiment, the work was presented in the above-mentioned way. The images were selected as to maintain the proportion of images with triangular and rectangular shapes and the representativeness of the images to be presented. The latter was quite difficult to achieve, especially for the second part of the work, since the images with rectangles have a higher chromatic complexity, and therefore, a higher variability from image to image. The global work could have been projected with the digital projector; however, it was decided to present the same images in both projections to avoid undesirable differences in the two scenarios of experimentation.

Additionally, according to the projector at use, different stands had to be employed. In scenario A, the digital projector was placed over a small grey table, and in scenario B, the slide projector was set over a white plinth.

The difficulties encountered during the preparation of this experimental study illustrates the kind of issues faced by institutions when exhibiting slide-based artworks, due to the obsolescence of the image carriers and display equipment.

The target population of this experimental study was the public at large. However, an intentional sampling was collected by personally inviting some individuals, such as professionals from the conservation field outside of the academic world, as well as university professors and colleagues. This sampling was intended to put together a group of people who was familiar with art and frequently visit exhibitions, being particularly able to respond to the present investigation. Nevertheless, there was no intention of analysing differences in responses by area of training or level of education. In addition, first year Master students from the Department of Conservation and Restoration (DCR) were formally invited to participate in the study, as part of their academic training. At the end, the sample consisted of thirty-nine persons (number of persons who observed the two scenarios of presentation and filled out the questionnaire), twenty-five of which participated in the workshop. The total number of visitors is unknown.

The characterization of the interviewees is presented in Figure 9. Most people who participated in the study are Portuguese. The age of the respondents ranged from 21 and 70 years (average: 34). The great majority are from the conservation and restoration field,

either conservators or (mainly) students. Since the conservation and restoration degree is, statistically speaking, predominantly attended by female students, these were the majority amongst the respondents.

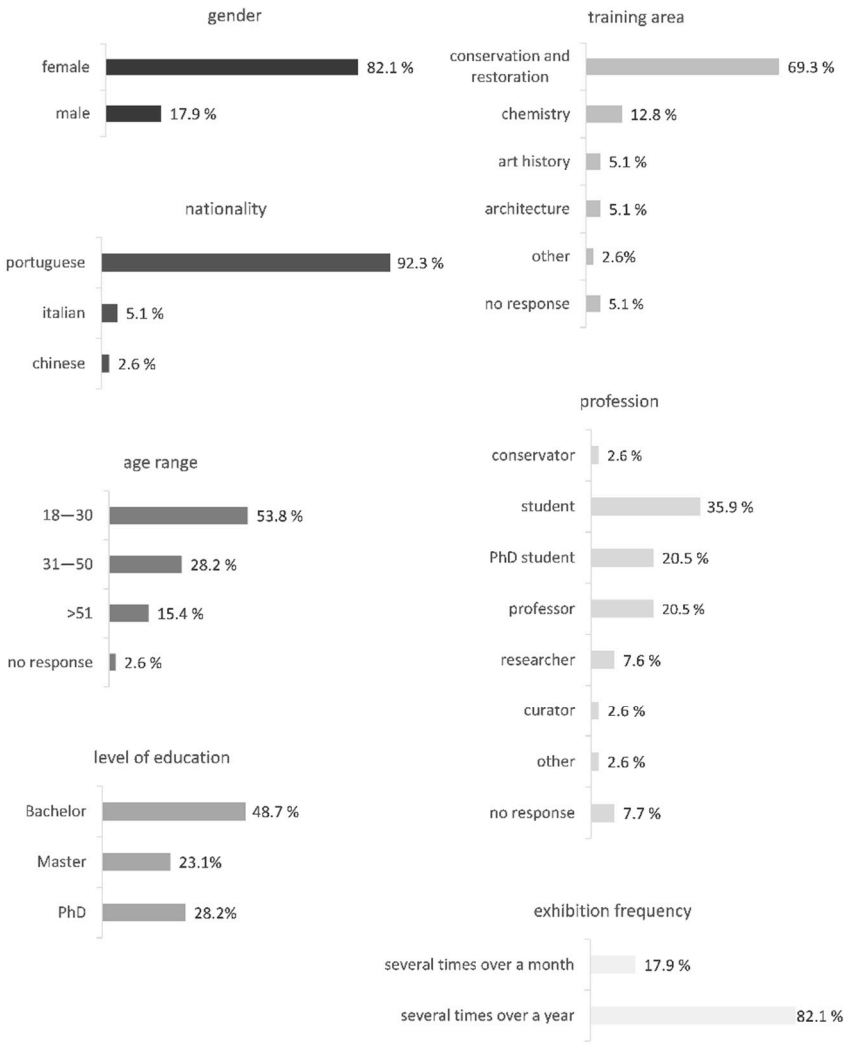

Figure 9. Frequency (number) of the responses regarding the characterization of the 39 people who answered the two questionnaires.

The respondents are people who often visit exhibitions, as expected. All questionnaires were filled in by persons with a higher education diploma.

An attempt to correlate the characterization of the respondents with the obtained results was made. However, no statistically relevant relationships could be established. The results obtained by comparing the two scenarios of experimentation against the evaluation criteria (i) image quality and beauty, and (ii) global scenario/installation, are summarized in Figures 10 and 11. When comparing the two scenarios of experimentation, within the various parameters, a significant difference emerge by applying a nonparametric test for matched or paired data, the Wilcoxon signed rank test ($p < 0.001$) [26]. Overall, the respondents had a better appreciation of the experience of the artwork presented with the slide projector than with the digital projector.

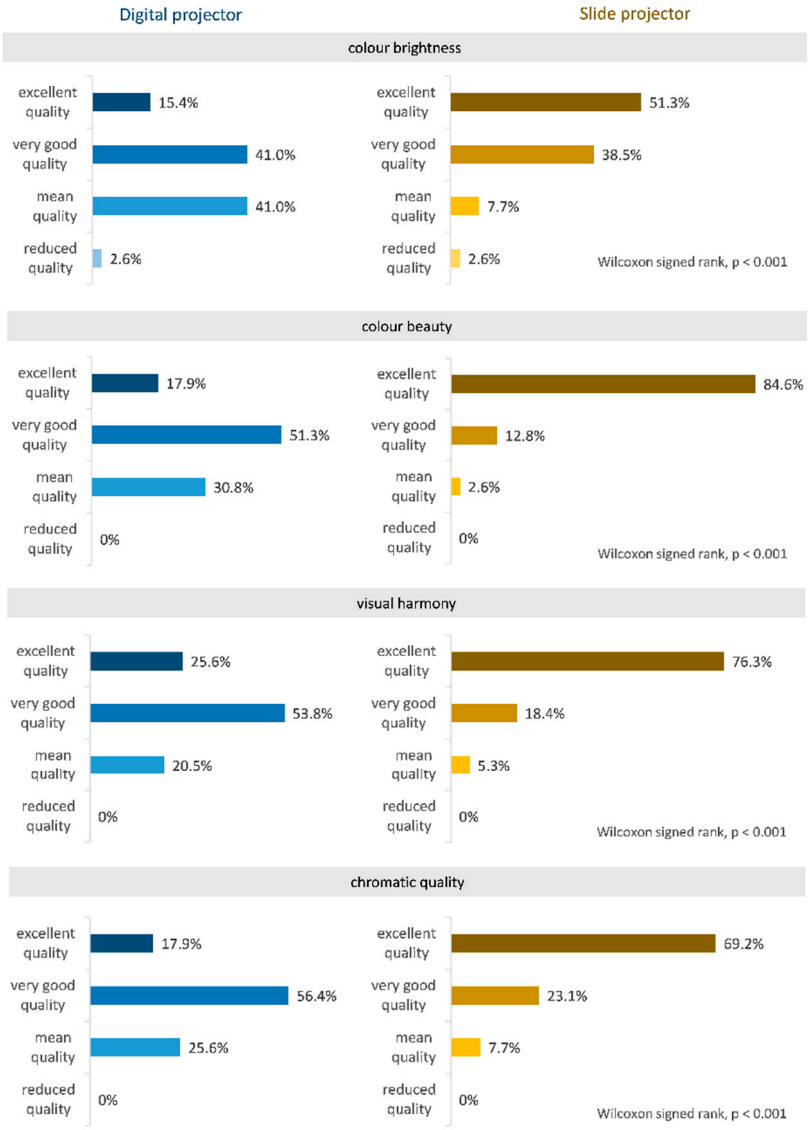

Figure 10. Frequency (%) of responses to questions regarding the image quality and beauty (total of 39). Graphics in blue represents the digital projector and graphics in yellow the conventional slide projector.

Regarding the image quality and beauty, most respondents classified the several variables of the digital projection as having good quality, with the slide projection as having excellent quality. Regarding the slide projection, the variable "colour beauty" can be highlighted, having 84.6% of the respondents classifying it as having excellent quality. The "colour brightness" had the worst classification among the slide projection, with only 51.3% of the respondents considering it as having excellent quality. Nevertheless, this variable had a far better classification than it had with the digital projection. In general, the evaluation of the digital projection is more distributed amongst all variables (values spread between excellent and mean quality), than it is for the slide projection. Regarding the global scenario/installation, the same trend was observed in a more discernible way. In the slide projection, all variables were classified above 70% as having excellent ambience. Thus, there was a very clear positive appreciation of the global scenario/installation for the slide projection. In the classification of the digital projection, the opposite emerges. The evaluation is distributed between excellent and bad ambience. The variable "harmony between work and projection" in the slide projection should be highlighted since 94.6% of

the respondents classified it as having excellent ambience. This classification shows a high contrast with the classification of the same variable in the digital projection, in which only 23.1% of the respondents considered it as having excellent ambience and 10.3% considered it as having a bad ambience. Regarding the variable "sound of the projection," 28.6% of the respondents considered that in the digital projection there was a bad ambience, whereas in the slide projection 78.4% considered that there was an excellent ambience. Nevertheless, this variable was quite ambiguous for a certain number of people, since the sound was absent in the digital projection. This fact is reflected in the percentage of respondents that did not classify this variable (10.3% missing). Similarly, it can be concluded that certain people also had difficulty in classifying the variable "beauty of the projection," since 5.1% of the sample did not respond.

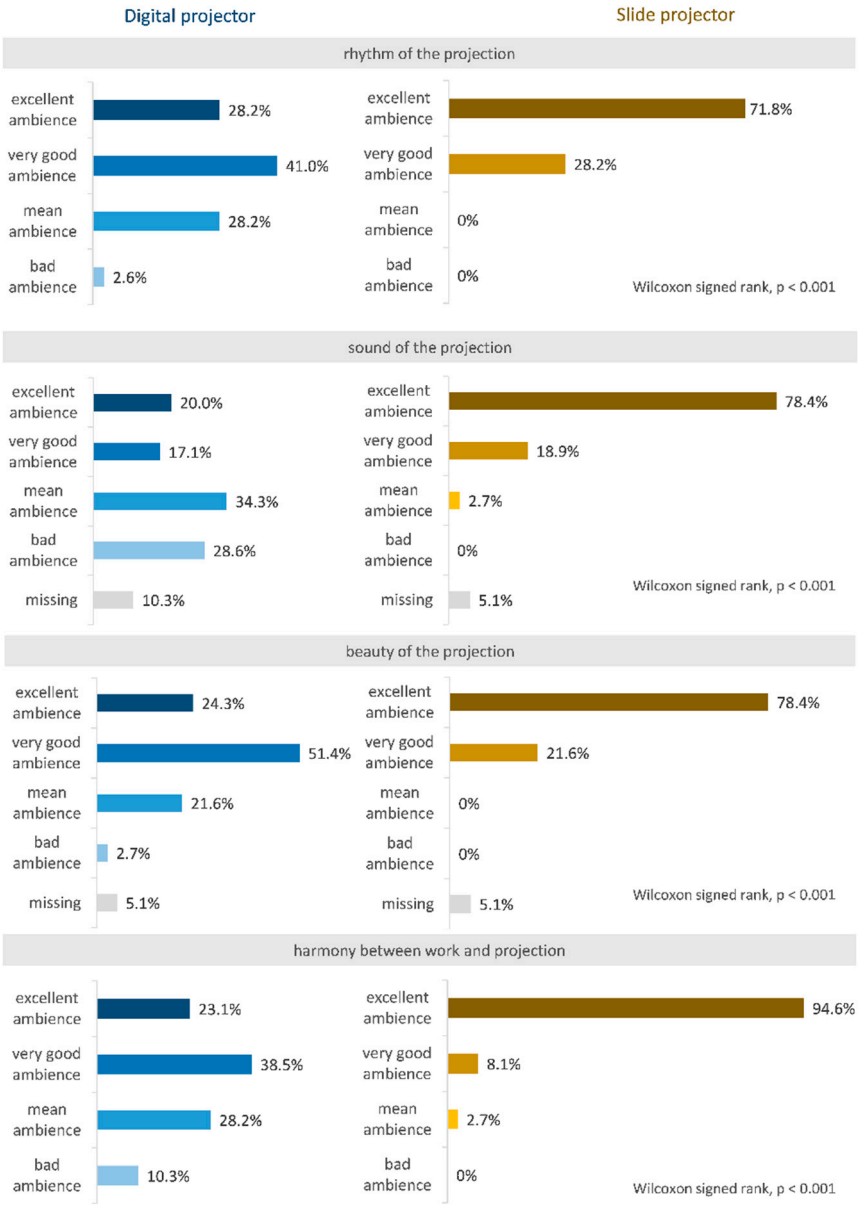

Figure 11. Frequency (%) of responses to questions regarding aspects of the global scenario/installation (total of 39). Graphics in blue represent the digital projector and graphics in yellow the conventional slide projector.

The impact of the attendance of the workshop in the perception of the artwork was studied by applying a nonparametric test used to compare two samples and detect non-normality, the Kolmogorov-Smirnov test, to each presentation scenario and evaluation parameter [26]. In general, it can be stated that the attendance of the workshop had no statistical relevance in how respondents evaluated the various parameters. This finding might indicate that, independently of the visitors being informed about the production process of the artwork, they still prefer it presented with the slide projector.

It is important to emphasize that the described information was obtained from questionnaires made to a very specific population. As previously mentioned, most of the people who visited the exhibition came from the conservation field. Normally, conservators are trained to observe and study the materiality of objects. Therefore, this characteristic almost certainly influenced their perception of the artwork under consideration. People from other fields, however, were also part of the population who answered the questionnaires and shared their experience of the work within the two scenarios. Moreover, according to the statistical treatments applied to the obtained data, no special trends could be established for the different professions or fields of expertise of the respondents.

In addition to the statistical treatment of the questionnaires, sixteen oral testimonies (41% of the respondents) were collected to enrich the obtained data. From these testimonies, eleven people clearly showed their preference for the slide projection, which is in line with the results obtained from the questionnaires. A few individuals claimed that the work does not make sense presented with the digital technology, especially if projected on a canvas over an easel. Some people also mentioned the importance of the slide projector as a testimony to the production process. Thus, the removal of the slide projector from the presentation of the artwork would mean the removal of a significant part of the work. Following the same idea, some people also mentioned the importance of the original technology in the historicity of the work. Additionally, some respondents raised the importance of the slide projector for the maintenance of the materiality of the work. A slide projection is a result of the passage of light through a chromogenic reversal film, which is matter, while a digital projection is based on the emission of light, which has a different appearance. One respondent also argued that the digital projector somehow removes the installation character of the artwork. Some people, however, considered that the use of a digital projector to present the artwork is an acceptable possibility. Some people, knowledgeable of Ângelo de Sousa's work, claimed that the artist would have been amenable to the mutation of the work into a digital format. Regarding the perception of the image in both scenarios of experimentation, in a general way, people preferred the quality and beauty of the image projected with the slide projector. Three people noted that the most important aspect to consider in the evaluation of the artwork is the quality of the image. Several people mentioned, as positive outputs, that the slide projection produced an image with more granularity, with warmer hue, and was less flat and homogeneous when compared with the digital projection. Some people also highlighted the fact that a higher depth of the images was achieved with the slide projection (conferred by the darkness of the corners), an aspect lost in the digital projection. The sound of the projection was a variable often mentioned in the oral testimonies. Two respondents noted that the sound from the slide projector could be somehow disturbing, distracting the attention from the images themselves. In one testimony, it was noted that the absence of sound could lead to a sort of a sublime state during the observation of the sequence of the images. However, the majority of people considered the presence of the sound, so characteristic of the slide projector, as an important factor, by conferring a narrativity to the artwork and capturing the visitor's attention. The rhythm of the slide projection, induced by the passage of the slides, was also mentioned as a positive outcome that would create the feeling of a sequence or a narrative. One respondent mentioned that the digital projection looked faster than the slide projection, possibly due to a more sudden transition between images.

Besides the oral testimonies, relevant information that arose from conversations between visitors during the exhibition time was collected. From this observation, it is worth

mentioning that various students had never seen a slide projector before this exhibition. Some did not even understand, at first, if the artwork was being displayed with a digital or a slide projector. When some of the students saw the slide projector, they were very enthusiastic about it. This leads to the conclusion that the subtraction of the original technology might bring especially significant consequences for the future (and current) generations. Even if it is explicit to the public that the original technology consisted of projected slides, people who do not know what a slide projector is might not be able to understand what it entails since this technology is no longer part of our everyday lives.

4. Conclusions

Slides de cavalete | *Easel slides* is one of the most ingenious photographic works produced by Ângelo de Sousa. The coloured images were produced by projecting white light from a slide projector through filters with the additive primary colours, red, green, and blue (RGB), and capturing a superimposition of these lights successively, on the same frame. The thorough analysis of the documentation left by the artist was the basis for the comprehension of the images composing *Slides de cavalete*. Nevertheless, reproducing the production process was essential for a complete understanding of the artwork. Only after this practical experiment was it possible to understand certain subtleties required to obtain the colour gradations (using the "sfumato" method), which were not explicit in the documentation left by the artist. This task also allowed for the recognition of the difficulty and complexity of the execution process.

During the artist's life, the work was presented as a slide projection in a canvas placed over an easel. In the letter concerning its exhibition at FCG, he specifically calls for "an easel, of the atelier type, the more nineteenth century the better, and if it had a crank, then it would be the best," showing how important this detail was for him (which comes as no surprise, considering the title of the work) [21]. After the artist's death, the artwork has been exhibited following different display setups. In 2017, the work was shown, for the first time, as digital projections on the museum's wall. To test the variability of the work projected with a digital projector and a slide projector, an experimental laboratory was organized in an exhibition room at the FCT NOVA's Library. For four days, the visitors were invited to see the work displayed with the different kinds of projections. To capture the perception of the public about the work presented under these two scenarios of presentation, the visitors were invited to fill out a questionnaire. The results obtained from the questionnaires were very explicit and demonstrated that the respondents clearly preferred the experience of the artwork presented with the slide projector when compared with the digital projection. In general, the public preferred the quality and beauty of the image using the original technology. Granularity, hue, and higher depth of the images were highlighted as positive outputs of the slide projector. Thus, besides being fundamental to produce the artwork, the slide projector seems to play an important role in its presentation. It is important to take into account that the great majority of the respondents were from the conservation field, a factor that might have weighted in the obtained results. It would be interesting to replicate the experimental laboratory in other institutions, and to verify if a trend can be established with an increased degree of certainty. In summary, considering the production process, the way of working of the artist, the history of the artwork and the results of this experimental laboratory, it is proposed to display the artwork in the future resorting to the original technology.

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Institutional Review Board Statement: Ethical review and approval were waived for this study, given that the questionnaire was completely anonymous, and no personal data can therefore be exposed. The participants were informed about the scope and purpose of the study.

Informed Consent Statement: Participants consent was waived since the questionnaire conducted for the present study was anonymous.

Data Availability Statement: Raw data (questionnaires) are not publicly available since all information supporting the finding of this study are available within the article. Raw data are available on reasonable request from the corresponding author.

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