

Seeing the whole picture: an interdisciplinary research model applied to the study of colour slide film collections

Ver a imagem no seu todo: um modelo de estudo interdisciplinar aplicado ao estudo de coleções de diapositivos a cor

LÉNIA OLIVEIRA

FERNANDES ^{1*} EMÍLIA TAVARES ²SUSANA FRANÇA DE SÁ ¹ ÉLIA ROLDÃO ¹ 

1. LAQV-REQUIMTE,
Department of Conservation and
Restoration, NOVA School of
Science and Technology, 2829-516
Caparica, Portugal

2. Museu Nacional de Arte
Contemporânea – Museu do
Chiado (MNAC), Rua Serpa
Pinto, 4 | Rua Capelo, 13, 1200-444
Lisbon, Portugal

*lji18422@campus.fct.unl.pt

Abstract

Chromogenic film is a significant part of twentieth-century visual culture, yet guidelines for such photographs rarely integrate material, technical, and cultural characteristics into their conservation. As a result, millions of slides and transparencies are neglected within institutional decision-making. This article presents an interdisciplinary methodology combining an online survey – gathering testimonies and assessing current perceptions – and the assessment of c. 54,000 photographs in Portuguese collections. The combined approach proved effective in identifying recurrent deterioration issues, gaps in reference resources, and contextual factors shaping the value and interpretation of these types of photographs, including its role in contemporary artworks. Documenting both material and immaterial significance emerged as essential for supporting preservation strategies and avoiding further decay. While the method is time-intensive and shaped by qualitative variability, its holistic perspective offers clear advantages for future research. The framework provides a replicable tool for understanding and preserving chromogenic film photographs in Portugal and beyond.

Resumo

Os diapositivos cromogéneos em película fazem parte da cultura visual do século XX, mas diretrizes para a sua conservação raramente integram características materiais, técnicas e culturais. Consequentemente, milhões de slides e transparências são negligenciados na tomada de decisões institucionais. Apresenta-se uma metodologia interdisciplinar combinando um inquérito online – com testemunhos e perceções atuais – e a avaliação de aproximadamente 54.000 fotografias em coleções portuguesas. A junção destas abordagens auxiliou na identificação de problemas de deterioração recorrentes, lacunas nas fontes referenciais e fatores contextuais que moldam a perceção deste tipo de fotografias, incluindo em obras de arte contemporâneas. Documentar tanto aspetos materiais e imateriais revelou-se um apoio essencial para desenvolver estratégias de preservação e evitar degradação contínua. Embora o método seja moroso e influenciado por fatores qualitativos, a sua perspetiva holística é uma vantagem para investigações futuras. É também uma ferramenta replicável para a compreensão e preservação de fotografias em filme cromogéneo.

KEYWORDS

Chromogenic film
Photograph conservation
Obsolescence
Memory
Values
Collection surveys

PALAVRAS-CHAVE

Filme cromogéneo
Conservação de fotografia
Obsolescência
Memória
Valores
Levantamento de coleções

Introduction

After almost a century since the introduction of the daguerreotype, and preceded by additive colour and assembly processes, chromogenic or dye coupler technology marks a turning point in the production and use of colour photography. Corporations such as Kodak and Agfa began mass-producing colour slide film in the mid-1930s, a sector of the photographic industry that remained active for more than 70 years [1, pp.160-164, 298-303; 2-5]. Visual culture's shift towards digital media over the past twenty years has slowly overshadowed the contributions of analogue colour photography to cultural memory. Colour slide projections were common at family gatherings, used for technical and scientific lectures and an important documentation tool in many contexts. Numerous publications were illustrated with images that originated from these contexts, and chromogenic film was also adopted by artists to create colourful and dynamic artworks [5-8].

The main components of colour slide film are a transparent plastic support (cellulose acetate or polyester) and a gelatine emulsion with separate layers with yellow, magenta and cyan dyes [1, pp. 181-184; 2-5]. Each film type had its own characteristics and processing requirements, and significant efforts were made over the years to improve their properties – particularly the stability of the dye-based image-forming materials and processing efficiency [1, pp. 161-164, 170-171, 176-177, 181-184; 2; 4-5] (Figure 1). Despite those efforts, it was not uncommon for colour shifts to become visible shortly after chemical processing or projection. Colour shift and fading occur even under dark storage conditions, at a faster pace in environments without controlled temperature and relative humidity. In humid conditions, additional risks arise: biological contamination is likely to develop, and the cellulose acetate base becomes increasingly susceptible to acidic hydrolysis. Over time, these conditions can lead to mould growth and the progressive acidification and degradation of the film support [1, pp. 186-189, 203-204; 2-3; 5; 8] (Figure 2).

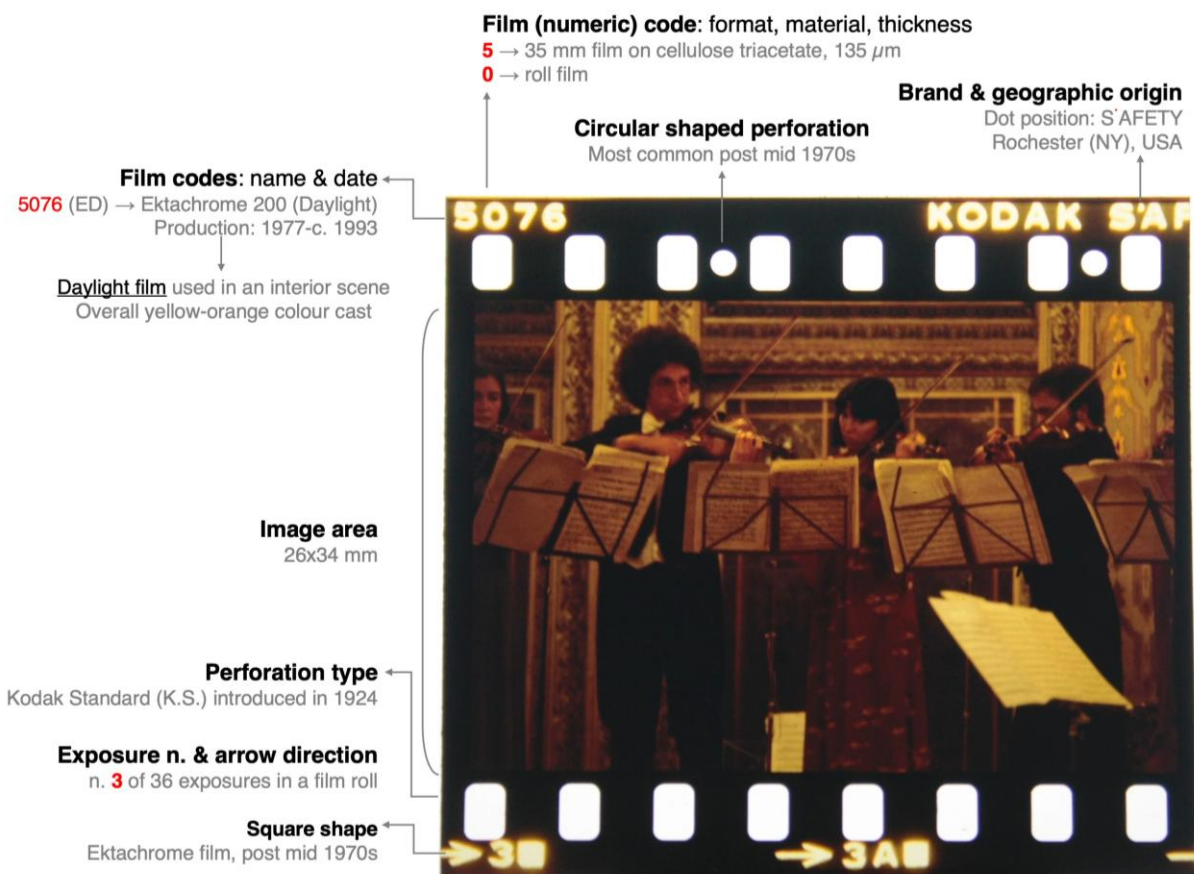


Figure 1. Example of how information can be obtained by observing the edges of a 35 mm colour slide, combining information from different sources [1, p. 301; 4, 40] (Image: L. Oliveira Fernandes).

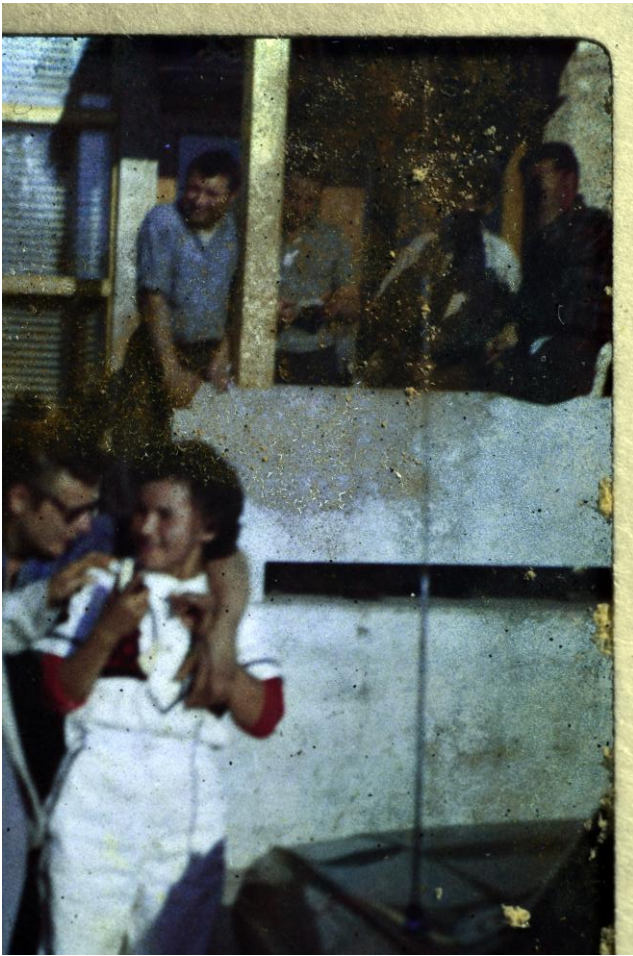


Figure 2. Detail of a Kodak Kodachrome 35 mm colour slide developed in February of 1963, emulsion side, viewed with transmitted light (LED table). Both the film and the surrounding cardboard mount are affected by mould growth. The most damaged areas look darker, and the emulsion is beginning to crack and separate from the plastic support. Private collection, Tito Flores (Photo: L. Oliveira Fernandes).

Now produced in much smaller quantities, slide film continues to be made and remains a relevant artistic medium, although an increasingly problematic one [9-10].

Projection, and the associated light and heat exposure, can be very harmful. In case of damage, it is virtually impossible to replace older chromogenic film with the exact materials that were once used. Film production has essentially come to a halt since the late 2000s, and unlike other processes, reconstructions would require the photographic industry's immense know-how and infrastructure.

We are at a turning point, when it is still possible to document how these materials were made and used before the memories from those who had first-hand experiences with these materials completely fade away from society's collective memory [11]. This increasing knowledge gap is detrimental to their care, as the weakening significance of immaterial values and disappearing knowledge about their materiality inevitably leads to neglect. It is crucial to record previously undisclosed information, integrate perspectives on their production, use and decay, and raise awareness of these photographs' cultural relevance. Despite efforts focusing on specific brands and collections, millions of colour slides in both public and private collections continue to be overlooked. Still, substantial work can be undertaken to safeguard these materials for the future [1, pp.186-189; 2; 5; 7-8; 10]. Moreover, most currently available resources address aspects of colour slides without integrating them with into a bigger picture. There are few sources contextualizing and describing manufacturing information, and even though more companies produced slide film, Kodak products tend to be emphasised [1, pp. 182-184, 298-303; 4-5] (Figure 1). Specialized databases can help in technical aspects such as film identification and dating, but existing resources need more context and depth that reflect on

how specific contexts and practices add different values to these objects [12]. Literature exploring accelerated aging has extensive descriptions and graphs to explain how films change in different conditions, but few comprehensive illustrations are provided for each film's characteristics and behaviour [5]. Conservation literature explains colour slide film decay in a global way, stressing the importance of implementing preventive measures to avoid the development of issues such as discolouration, fading and biological decay [1, pp. 186-189, 203-205; 2-3; 7]. Most sources explaining how to plan and execute collection surveys; fewer exist for photographic collections and rarely address the characteristics that are specific to colour slides. [2, 7, 13-15]. For this reason, it is also necessary to consider aspects that go beyond those typically addressed when examining prints and negatives, including contextual information. When colour slides are integrated into time-based media artworks, it is also necessary to understand how the projection is organized (e.g. image sequence, time per image) and exhibition requirements (such as the characteristics of the exhibition space, size of projected image, etc.) [10, 16-18]. While treatment methods are seldomly mentioned, the unwanted alteration of slide film has often been resolved by reproducing photographic images in similar materials [2, 5, 7, 10]. Consequently, this strategy relies on the creation of new objects. However, they are seldomly exact replicas of the object they originate from. It is not guaranteed that the subsequent generation of photographs has been produced in a film with similar sensitivity and grain, or dyes with comparable ageing behaviours. Moreover, reproduction may (intentionally or unintentionally) yield photographs in different sizes, and/or crop part of the original image [10]. Assuming a copy of a colour slide has the same properties as its source material is a fallacy. To generate more knowledge about these objects it is first necessary to access and interpret several different information sources, resulting in more well-rounded idea of their complexity (Figure 1).

One of the aims of this research is to develop a deeper understanding of colour slide film within an international context and correlating that with objects in Portuguese collections. Most sources on photographic materials, and specifically dedicated to colour slide film, tend to highlight large companies and the regions in which the industry developed, namely Kodak in the U.S. and Agfa in Germany [1, pp. 169-170; 4-5; 10; 12]. Its impact elsewhere has been far less explored. As far as known, Portugal did not establish a domestic photographic film manufacturing industry and therefore functioned as an end-user of imported materials. Furthermore, its social context was defined by cultural isolation caused by decades of a dictatorial regime that only fell in 1974 [19]. Its unique position and context offer a distinct vantage point that has never been studied. This opportunity allows investigating the perspective of an 'outsider' on discourses around the reach and influence of the global photographic industry, and how it affected the country's photographic heritage. As it is impossible to characterise all individual photographs on colour slide film present in the country, selected case studies exemplify their range and diversity in collections, brands, uses and values, as well as preservation and conservation issues.

Pressing material and immaterial concerns about colour slide film collections in Portugal will be pinpointed by documenting contextual information (such as testimonies), gathering object-based data (case study assessments), and connecting them with artistic, technical and vernacular sources. As objects found at a global scale, these issues are likely transversal to several collections.

Materials and methods

Online survey

Our understanding of colour slide film collections can be enhanced by gathering first-hand accounts of those involved in the objects' life cycle through online surveys. For this phase of the project, an online survey was set up to gather information about how the public currently perceives colour slides, more than a decade after most film production was discontinued. The goals were to collect participants perspectives on the use, production contexts, significance and values associated with colour slide films. The participants' background was also taken in consideration and related with the data on the topics mentioned.

The survey's structure was divided into the following sections (Table 1):

- Project's overview and goals;
- Participant's profile (country of residence, age group, professional background and fields of expertise);
- Participant's level of familiarity with colour slide film, and contexts associated with these materials;
- Participant's evaluation of values and the significance of colour slide film, its decay and technological obsolescence;
- Additional information on the participant's profile (country of origin, highest level of education, gender);
- Acknowledgements: participants could leave their feedback and provide their e-mail to receive more information about the research.

The survey was available in two languages, English and Portuguese [20-21]. Overall, participants could choose from their answer from standardised options, organized in alphabetical order. If they considered these choices insufficient and/or wanted to explain their selection, it was possible to elaborate on their answers on the comment sections. Most questions were mandatory but those requesting complementary information (e.g. gender, country of birth) were optional or offered a "Prefer not to answer" option. For example, questions addressing time-based information requested answers in decades instead of years:

- to ensure the participant's personal details remained anonymous (their specific birth year);
- to obtain responses when the participants' memory is no longer accurate (the exact year in which they first saw colour slide film).

Prompts provided in the "Associations" section can be viewed in Table 1. These sentences were rated using a Likert scale, with the values "Strongly agree", "Agree", "Neutral", "Disagree" and "Strongly disagree" [22]. The list of evaluated values was inspired and adapted from those compiled by Fredheim et al. [23]. The lack of neutrality in the presented prompts was meant to cause participants to react and encourage them to potentially add open-ended comments, explaining why they disagreed with the presented sentences.

Table 1. Prompts provided in the "Associations" section of the online survey.

Colour slides are ...	Colour slides can have ... value.	Give your opinion on the impact of colour slide film.
carriers of detailed images complex	artistic / aesthetic cultural	The production of these materials had a <u>negative</u> environmental impact.
difficult to preserve	documental / historical	The production of these materials <u>should continue</u> .
familiar	educational	
long lasting	immaterial / symbolic	These materials had a <u>strong impact</u> in society.
old-fashioned / vintage	material / physical	
rare	market / monetary personal / emotional scientific technological / industrial	These materials had <u>higher quality</u> than digital-born photographs.

The web-based platform used to make the survey available online was Microsoft Forms, as it has a user-friendly interface that allows data exports. After a trial phase and a few adjustments, the survey was made public on November 14th, 2023, and responses were collected up to August 6th, 2024. Its online distribution (through email, social media channels, newsletters, etc.), asked all volunteer respondents to forward the survey to more potential participants. Therefore, contributors were accumulated through non-probability snowball sampling [24]. Participants could choose which of the two available languages they preferred to use in the introductory section [20-21]. Responses to the two separate Microsoft Forms surveys were exported and combined in a separate Microsoft Excel file. Data analysis and interpretation were carried out using this software, as well as other visualisation tools.

Collection surveys

Selecting case studies

In addition to gathering contextual information, data on colour slide film was obtained through the assessment of six case studies held by five institutions [25-30] (Table 2):

- Arquivo Documental de Fotografia (ADF) – This specialized government archive centralizes and cares for many photograph collections associated to national institutions, such as museums and monuments. The chosen case study documents the activities surrounding the Laboratório José de Figueiredo (LJF), the Portuguese centre for conservation and restoration;
- Biblioteca de Arte e Arquivos (BAA) – Part of a private foundation, the art library of the Calouste Gulbenkian Foundation is a reference for the study of architecture, art and the applied arts in Portugal. Its archive incorporates artists estates, many of which often include photographs. In this setting, the Estúdio Horácio Novais estate is highlighted as an example of the use of chromogenic film in commercial photography;
- Coleção de Arte Contemporânea do Estado (CACE) – With diverse holdings, this government owned contemporary art collection actively continues to actively acquire artworks from Portuguese and international artists, including those using photographic materials as an expressive medium. A closer look is taken into *Road Works* (1997), an art installation by Augusto Alves da Silva (AAS);
- Museu Nacional de Arte Contemporânea – Museu do Chiado (MNAC) - This national museum's collections contain a wide range of artworks from the 1850s onwards. One of its focus areas is photography and new media, which includes two artworks incorporating colour slides: one by João Tabarra (JT) and another by Pedro Paiva & João Maria Gusmão (PP & JMG);
- Museu Nacional de História Natural e da Ciência (MNHNC) – The holdings of this museum are closely connected to education and scientific research currently under the custody of the University of Lisbon. Its photograph and audiovisual collection includes photographs from the Jardim Botânico Tropical (JBT), depicting research conducted by engineers and botanists in the premises, as well as in former Portuguese colonies.

Table 2. Overview of the chosen case studies and their characteristics.

Institutions (acronym)	Case study (acronym) [References]	Initial context of use	Dates (pre-survey)	Format range	N. of objects per collection	Assessment (relative %)	
						Group	Individual
Fundação Calouste Gulbenkian (FCG) - Biblioteca de Arte e Arquivos (BAA)	Estúdio Horácio Novais (EHN) [25, 34]	Commercial	c. 1940s – 1988	18 mm – 40×50 cm	11,677	5,234 (45 %)	394 (3.4 %)
Universidade de Lisboa (UL) - Museu Nacional de História Natural e da Ciência (MNHNC)	Jardim Botânico Tropical (JBT) [26, 35]	Scientific Educational	1953 – c. 1970s	35 mm – 6×6 cm	c. 4,421	c. 4,421 (100 %)	344 (c. 7.7 %)
Museus e Monumentos de Portugal E.P.E. (MMP) - Arquivo de Documentação Fotográfica (ADF)	Laboratório José de Figueiredo (LJF) [27, 36]	Documental Educational	c. 1940 – 2010s	35 mm – 18×24 cm	c. 36,597	c. 11,348 (c. 31 %)	493 (c. 1.3 %)
- Coleção de Arte Contemporânea do Estado (CACE)	“Road Works”, A. Alves da Silva (AAS) [28]	Artistic	1997	35 mm	972 + 6 (324× / group)	978 (100 %)	26 (2.7 %)
- Museu Nacional de Arte Contemporânea – Museu do Chiado (MNAC)	“Les revolutionnaires et la strip'teause”, J. Tabarra (JT) [29]		2000		80	80 (100 %)	6 (7.5 %)
	“O Grande Jogo”, P. Paiva & J.M. Gusmão (PP & JMG) [30]		2005	6×6 cm	76	76 (100 %)	8 (11 %)
Total					c. 53,829	c. 22,137 (c. 41.1 %)	c. 1,271 (c. 2.4 %)

The chosen organisations represent the variety of uses slide collections have had, as well as the different contexts in which are preserved in Portugal. They are mostly concentrated on a few dozens of institutions in and around the capital, making it possible and more practical to visit these locations multiple times. The case study selection was made with the interest in showcasing a wide range manufacture and use dates, manufacturing brands, original use, associated values, use and storage histories, and degradation issues. Three conservators and one curator employed by a range of Portuguese governmental and non-governmental institutions located in the Lisbon metropolitan area were approached to discuss the topic. All these heritage professionals have extensive experience with the management and care of photograph collections and understand the specificity of the Portuguese context. Furthermore, they provided insight into their professional practice along the years, and the technical and ethical challenges faced in preserving these materials. During meetings with stakeholders, sample groups with a wide range of uses, values, and degradation patterns were identified. Preliminary visits to several storage locations were carried out alongside collection conservators and curators. These visits provided an initial overview of the proposed case studies, including their main characteristics, condition and histories (Table 2).

Group and individual assessment

A literature review helped clarify that non-arbitrary sampling, often used in collection surveys, aims to obtain quantitative results that are as unbiased as possible. To do so, the sample is usually pre-defined [2, 13-14]. In this case, the defined condition survey methodology strives to focus more on qualitative information to disclose the diversity of the surveyed objects within countries located in the same country [31-32]. It was also important to obtain as much data as possible in a standardized way across different types of collections [2]. The employed judgemental or purposive approach allows selecting standout objects within their respective groups for closer inspection and acknowledges that these specimens may not be statistically representatives of the population. The inherent sampling and observer bias by design are recognized and findings are interpreted within the conditions in which the data were collected [24]. Objects chosen for individual assessment were often part of larger groups, whose characteristics – including housing materials, number of objects per enclosure, processing errors, overall condition – were also recorded (Table 3). These criteria were gathered from several sources describing the characteristics of chromogenic film collections in other projects as well those sources related to the photographic industry and the conservation of photograph and audiovisual collections [1, pp. 181-184, 186-189, 298-303; 2-10; 12-18; 27; 33-39]. Such information provides contextual clues that help understand the condition of individual objects.

Table 3. Categories of information gathered during the collection survey of colour slide film collections.

Context	Film + Mount				Observations
	Group + Object (tertiary/secondary/primary)	Film production	Use	Deterioration	
Survey - Surveyor's initials - Date	Housing (incl. mount) - Type - Materials - Colours - Brand - Production location	Technique - Image type - Materials Format - Size - Configuration (roll /sheet) - Frame n. / shot n.	Image capture - Mirrored - Use of filters - Start/end of film roll Errors - Exposure (light leak, over- /underexposure) - Over-/underexposed - Processing (chemical stains, water droplet stains)	[See Figure 3 and Table 4] - Overall condition - Per type of damage	History of use - Publications Image - Content / details - Image rights Position (film/mount) Previous treatments Related objects - Other colour slides - Other objects - Related collections
Institution - Name - Location - Type of institution - Room/shelf/... - N. of objects/institution	Text - Printed/handwritten N. of objects / group	Manufacturer - Brand - Product name - Production location - Production dates - Sensitivity (ISO) - Daylight / tungsten - Processing - Symbols	Markings - Drying clamps - Inscriptions - Irregular/cut borders - Perforations - Scratched markings Applied media - Masks (inks, tape) - Protective coatings - Retouching media		
Collection - Name/code - Maker(s) / Artist - N. of objects/collection - Provenance - Content - Storage location - Storage environment		Generation - 1 st - 2 nd - 3 rd or more	Traces from previous mounts		
Object - Identification (inv. n.) - Content		Text - Printed/handwritten			

Gathering, analysing, and interpreting data from collections

Before beginning the evaluations, it was necessary to define which data to collect, how to collect it, and when to conclude this phase of the project. Given the variability in size and composition of the case studies, a proportional sampling strategy was adopted: at least 1 % of items were examined in large collections and up to 10 % in smaller, more homogeneous ones. Because some collections already had partial documentation in Microsoft Access or Excel, all information was standardised and managed in Excel, which offers flexibility, basic statistical tools, and compatibility with multiple export formats. All observations were recorded in a spreadsheet to facilitate consistent and controlled data recording.

Objects condition evaluation was conducted according to previous established approaches based on a five-level qualitative scale ranging from “Very good” to “Very deteriorated” (Table 4). This system, widely used in Portugal, provided a valuable baseline. Comparing past and current assessments allowed verification of prior records, identification of discrepancies, and reduction of repetitive descriptive work. It also enabled quality control of earlier documentation, such as the accuracy of material descriptions and recorded damages. However, it was considered that overall condition alone did not adequately express the severity or distribution of individual types of damage as desired for this study. Therefore, a second, more specific evaluation system was introduced, also using five levels from “no damage” to “very damaged” (Figure 3).

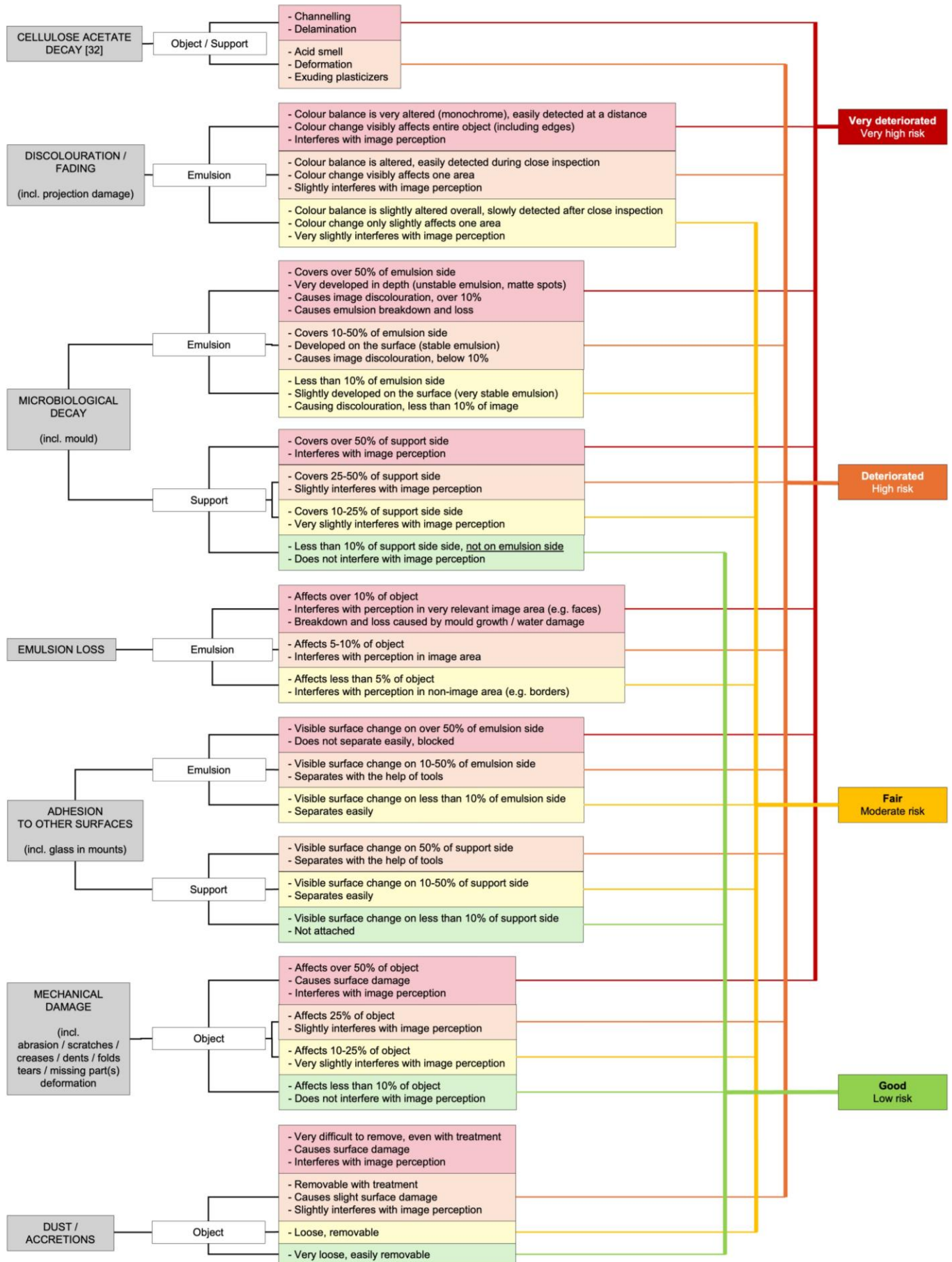


Figure 3. Condition evaluation guidelines for collections of photographs on chromogenic film depending on the detected types of damage and the percentage of the affected area.

Table 4. Condition evaluation system utilized in the assessment of the object's overall condition and specific types of degradation. The Portuguese terms for overall condition assessment are added for easier connection to the acronyms used in the databases where previous assessments were recorded.

Evaluation systems (5-level scale)						
Overall condition	PT (acronym)	Muito bom (MB)	Bom (B)	Razoável (R)	Deteriorado (D)	Muito deteriorado (MD)
	EN	Very good	Good	Fair	Deteriorated	Very deteriorated
Per type of damage	EN	Not visible	Barely visible	Slightly visible	Visible	Very visible
	Symbol		(- -)	(-)	(+)	(+ +)

Table 5. Examination and monitoring tools used during collection surveys, and providing relevant data.

Type	Purpose
Ambient light & lamps, light tables	Observe properties in reflected, transmitted and raking light
Digital microscopes	Observe properties in magnification
Digital cameras (smartphone)	Document viewed objects
Polarizing filters, technical literature & databases	Identifying plastic support
A-D Strips	Detecting deterioration level of cellulose acetate support
Dataloggers	Obtain temperature and relative humidity data for each location

The assessment framework was refined to address the specific properties of colour slide film, whose manufacturing and degradation characteristics differ from other photographic materials. Because no dedicated terminology or guidelines exist for this medium, criteria were compiled from technical literature, observed decay patterns, and insights from pilot surveys. Standardised dropdown menus in the spreadsheet accelerated data entry.

Sensory examination (particularly sight and smell) was complemented by simple, widely accessible tools used in conservation studios (Table 5). A set of visual reference examples, documented with digital cameras along the years and during the initial project phase, were organized and categorised per topic (e.g. material identification, production characteristics, deterioration). These files provided to three NOVA FCT conservation students, who were trained in the method and applied it the Laboratório José de Figueiredo photograph archive.

Results

Online survey

The online survey had a total of 445 participants associated to 53 countries, amassing over 16,300 data points. When analysing the results by geographic region, it became easier to simplify the results by comparing Portugal and seven world regions: Africa & Western Asia, Asia; Eastern & Southern Europe, Latin America, Northern America, Northern & Western Europe, and Oceania. These groups were defined using the standard of geographic regions as defined by the United Nations, and further combining areas with similar, economic characteristics which tended to yield similar answers [40]. This approach made it easier to compare Portugal's position in relation to other contexts and to condense the obtained data into less categories. The survey also proved to be a valuable tool for analysing factors that influence the perspectives of the various participants, such as age group, socio-economic background, and professional field. For example, most respondents remembered first viewing colour slide film in a private context (51.7 %) (Figure 4). The highest percentages are associated with people residing in Northern America (73.7 %), Northern & Western Europe (70.6 %), and Oceania (80.0%). Participants residing in Portugal were far below the average (34.1 %). In contrast, in Portugal colour slide film was more connected to an educational context (39.4 %). Such results suggest that the use of colour slide film in classrooms and other educational environments was quite impactful in this country.

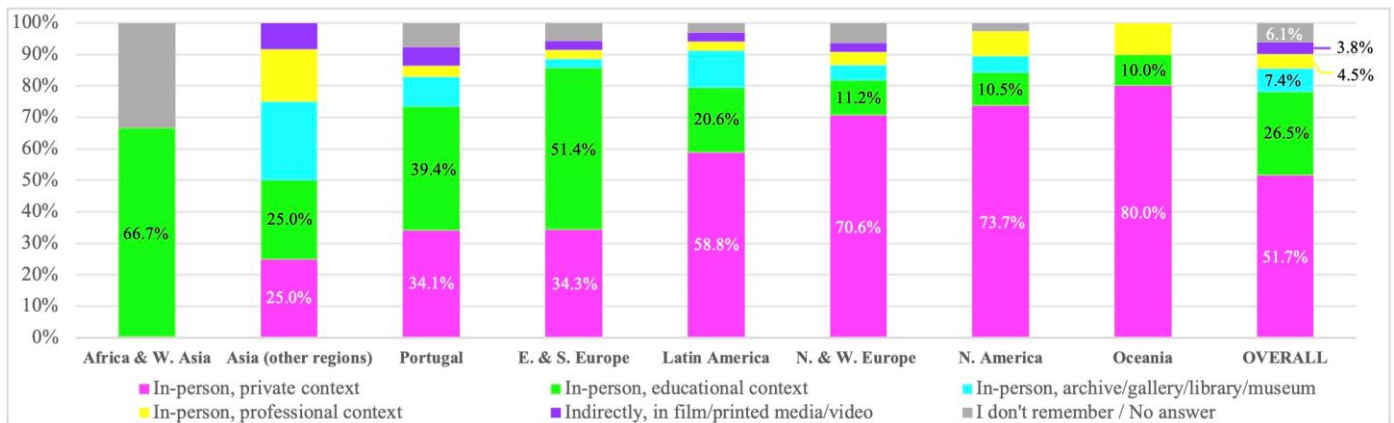


Figure 4. Chart summarizing online survey results. Answers provided to describe in which situation participants came across colour slides for the first time. The data is presented according to the participants' region of residence and was generated through Microsoft Excel (Image: L. Oliveira Fernandes).

Among over 800 open-ended comments, many opinions were clarified and provided nuance to the study. This section was also used to share personal stories connected to the participants' private life. A word cloud generated through the online platform Flourish highlighted the frequency in which social occasions were mentioned in the comments, when family members and friends bonded around the projection of colour slide film. Beyond that, it is a medium connected to peoples' identity and can evoke strong memories. Concerns were also expressed regarding the conservation of these materials, especially in relation to the instability of the different films' colour dyes and mould growth (Figure 2). As many participants identified as having a professional connection to cultural heritage, their awareness of colour slide decay was likely heightened in relation to the general population. A more in-depth analysis of the survey results was presented in September 2024, and the corresponding article was published in 2025 [41].

Collection surveys

Collection surveys took place during approximately 520 hours between March 2023 and May 2024. In total, the selected groups included close to 54,000 examples dated between the 1940s and 2010s. Access to reports as well as databases with records of previous assessments and treatments plans were generously provided by the different project partners [34-36]. Even though the number of objects at stake is expansive, many other examples could have been incorporated into this study. It could have been possible to explore connections between this type of photographs and wider contexts of use, such as in religious or military museums, or those that are kept in domestic settings and are owned by private individuals. However, this limitation in geographic diversity is counteracted by the locations where the visual content of these photographs was first acquired, or the images they depict. For example, the JBT collection has photographs depicting other parts of Europe, as well as Africa, Asia and Latin America [26, 35]. Similarly, the LJF case study documents examples of artifacts made abroad and brought to Portugal (e.g. ivory and wood from Southern Asia), connecting Portuguese cultural heritage institutions to others overseas (e.g. Real Gabinete de Português de Leitura, Rio de Janeiro) [27, 36].

An overall impression of object groups was obtained through over 22,100 objects. More detailed information was gathered for 1,271 colour slides. The establishment of an assessment framework and analysis criteria beforehand made it easier to interpret over 116,000 data points, enabling comparisons within and across case studies, as well as to compare results with documentation associated to previous registration and conservation. Even with care to standardize and simplify the collection assessment process, the sheer volume of collected data demands analysis and visualization tools that are more powerful, flexible and intuitive than a spreadsheet file. Other options will be further explored to correlate various aspects, for example, to identify trends between the object's condition to housing, film type and/or production date.

Slide film in formats ranging from 18 mm to 40 × 50 cm was assessed, and over seventy different product names were identified in the process. The most common brand of colour slide film found in these collections is Kodak, and its origin was identified as connected to the company's US factories (in Rochester, NY and Windsor, CO), but also from its French and British branches [37]. Other companies and locations were also detected (Agfa and Perutz in different parts of Germany, Fuji in Japan, General Aniline and Film in the US, Gevaert in Belgium, and Ilford in the UK). Similar trends are found in housing materials, reinforcing the impression that colour slide film and all associated packaging was imported into the Portuguese market.

The process of developing and applying a collection survey methodology specifically for photographs on chromogenic film reiterated the importance of paying closer attention to these materials and to holistically integrate different perspectives. Heritage professionals may be aware that their condition can vary immensely, as each film has inevitable inherent characteristics and vices. Still, even objects that are considered recent or stable may present issues, derived from their contexts of use and care along the years. The overall condition rating is not calculated by averaging or automatically prioritising the most severe issue; instead, assessors can weigh the relative risks associated with each issue (Figure 3 and Table 4). For example, slight colour alteration combined with minimal mould on the support may be classified as “fair”, whereas minor colour change with extensive mould on the emulsion warrants a “deteriorated” rating due to the higher risk to the object's stability. This approach requires assessors to evaluate each type of degradation independently and avoids the use of neutral categories, which results in a more assertive assessment.

Overall, the most pressing conservation issues these collections face result of improper storage. Onset decay may be connected to the objects' use and storage history. Moreover, there are often difficulties in implementing preventive conservation standards in institutions. As a country that has warm summers and humid winters, it is necessary to invest in creating stable environments, ideally with low temperatures and relative humidity to avoid the continuous decay of these types of photographs. Most of the assessed objects continue in the housing materials they were originally placed in, which likely containing harmful substances (e.g. volatile organic compounds, plasticizers). Such circumstances are likely comparable to those faced by many photograph collections in the country.

The combination of results from the online survey and the collection assessments has informed the focus of the next phase of the PhD. A detailed discussion is presented in the following sections.

Challenges

Conserving contemporary artworks with colour slide film

Discolouration was especially obvious in older films, likely due to the inherent characteristics of the objects, such as having been manufactured with dyes which quickly degrade if kept at room temperature [1, pp. 186-189; 2-3; 5; 7-8; 10; 16]. Although not as noticeable in recent films associated with artistic use, it is nonetheless an important issue as it goes beyond material decay and has been often discussed as a factor that leads to loss in perceived value [10, 16, 42-43].

It quickly became apparent that the installation “Road Works” by Augusto Alves da Silva (AAS) emerged as a piece in need of a deeper study, due to its significance in the artist's career, the artwork's evident physical degradation, as well as its complex history [28]. This artwork was originally created in 1997 and depicts a mountain road along the north of Spain, photographed by the artist at 10-meter intervals in two directions. The exhibition of its 324 colour slides can only happen following specific instructions defined by the artist, including the continuous display of the last slides in each group. In 1999, the piece was nominated for a prestigious award from The Photographers' Gallery London and is considered one of the artist's seminal works [44]. There are at least seven generations of the same artwork in several locations, one of which was acquired by the Portuguese government and incorporated into CACE (Edition 1 of 3). Each

photograph is housed in a Wess Plastic 5 × 5 cm plastic mount, with pin-registration and glass panels intended to flatten the natural curve of the used 35 mm film, as well as to protect it. However, repeated exhibition under projector light might and its emanating heat have contributed to its degradation. The film's presents uneven discolouration and plasticizers that have migrated towards onto the surface. Due to the way the work is presented, some photographs degraded more than others, which encouraged the creation of more image generations in the 2000s. Some of the produced sets were made without the artist's approval, raising ethical questions about authenticity and the weight of artistic intention that require nuanced investigation.

No interventive conservation treatment exists to restore dyes in chromogenic emulsions. In the case of prints, this often leads to reprinting as a conservation strategy [42-43]. In many circumstances, digital surrogates of slides are acceptable alternatives, especially when the value of the object is more connected to the content of the image it contains. In others, it is essential to consider the authenticity of the artwork's materiality and how that is reflected on the way it is presented to the public [16]. The only way to do so is by replicating the photograph in similar materials. As colour slide film production has almost entirely come to a halt, new, unexposed film is becoming scarcer and more expensive. There are also fewer practitioners who can use and manipulate analogue chromogenic materials with a high-level skillset. Therefore, producing new slides becomes a very challenging and expensive endeavour.

To reexhibit *Road Works*, it is necessary to consider the consequences and ethics linked to its continuous reproduction. It is essential to document how that process is viewed by the different stakeholders that have been involved with the creation, re-creation and care of the artwork and its multiples (the artist's representative(s), curators, conservators, collection managers, photographers). The passing of the artist in August 2025 adds a new layer of difficulty when interpreting the value of the different generations of the artwork. For this purpose, it will be important to conduct pre-structured interviews, utilizing oral history techniques [45]. It is also necessary to create guidelines for the artwork's preservation, preventing further issues with exhibition and reproduction, and to provide insights into conservation strategies for artworks with similar histories.

Facing microbiological decay on colour slide film

Another identified issue is that of mould growth (Figure 2). As these objects are made of emulsions composed of gelatine, they are highly susceptible to fungal infestation, especially in high humidity conditions. Such environments and the issues they cause are especially cumbersome when dealing with large collections. It is an issue that may start to develop before photographs are incorporated into institutional collections, and in such cases, preventive conservation actions (e.g. freezing objects) merely delay the inevitable. It has been reported that, if kept in the same conditions, colour slide film's emulsions are even more susceptible to microbiological attack than black-and-white photographs on film [38]. This type of deterioration can cause localized discolouration and alter our perception of the photographic image, and in more extreme cases ultimately lead to image loss. Moreover, it is also potentially harmful for other collections and for those who want to access them. These results can be connected to the conducted online survey results, where participants residing in different parts of the world mentioned the perceived frequency of this issue with sentences such as "Colour slides are always getting mouldy". Although this cannot possibly be true for all collections, it does underline the broadness of the problem, especially in contexts with challenging storage conditions.

The present survey allowed for the identification of mould growth in the Estúdio Horácio Novais (EHN), JBT and LJF case-studies [25-27]. In total, 606 (c. 48 %) of all individually assessed objects exhibited this issue. This was expected, as mould is a commonly reported problem in chromogenic photographs [1, p. 188; 5; 7-8; 10; 16; 38-39; 46]. Mould was detected in 255 (c. 65 %) of the 394 objects examined at the Calouste Gulbenkian Foundation (FCG) in 2023-2024. When

compared with collection's database records, only 134 (34 %) were previously flagged as having mould [34] (Figure 5). The remaining 121 specimens were previously considered to mostly be in fair or good condition and are often described as having surface dust. While it is possible that the condition of these objects has worsened, it is more likely that earlier assessments underreported the issue. The collection has been kept in a stable climate-controlled storage since its treatment (5-7 °C, 38 % relative humidity). The discrepancy in results is potentially connected to two factors: 1) information recorded in the project database was collected by several people which may have had slightly different ways to apply assessment criteria; 2) these surveyors had different levels of experience with colour slide film [47]. Generally, the most recent assessment tended to assign worse overall condition grades. Such divergence in results is especially related to the ability to identifying mould growth in earlier stages of development, as it can be barely visible, and magnification is essential for the untrained eye. Furthermore, the sooner the issue is detected, the higher the chances of slowing down its growth by putting appropriate conservation strategies in practice.

Given the widespread nature of this issue and its potential risks for collections and people's health, these findings emphasize the need for further research. Unlike discolouration, mould growth cannot be addressed by image reproduction alone, as on top of material authenticity issues, digitization and image editing software cannot improve the physical condition of the photograph. When it develops on the film's surface, only treatment can prevent the destruction of the emulsion [8, 10]. However, immersion treatment is not suitable for objects with unstable emulsions, which are also the most in need of stabilisation (Figure 2). Therefore, alternative treatment methods need to be explored. The use of ethanol, while effective in disinfecting chromogenic photographs, may solubilize the image forming dyes and alter the photograph's overall appearance [39, 46]. Its known toxicity for humans further motivates the search for safer, more sustainable alternatives that have comparable or higher efficacy.

In a next phase, this study will focus on identifying and characterizing the types of fungi affecting the case study collections and will be followed by tests to develop potential treatment alternatives with sample objects. If found to be efficient, it will be possible to implement a new, safer and more effective treatment procedure in photographs from institutional collections.

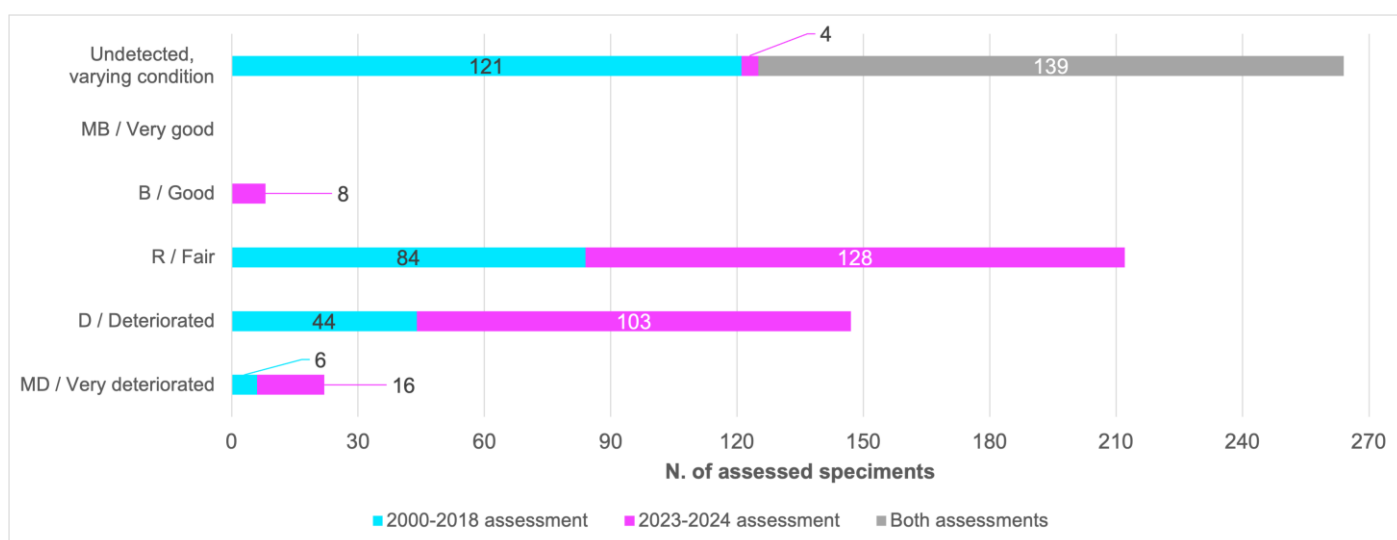


Figure 5. Chart summarizing collection survey results for the Estúdio Horácio Novais collection. Overall condition level and its relationship with the detection of mould growth on individually assessed specimens. Comparison between data from Microsoft Access database records [34] and new assessments. Graph generated through Microsoft Excel (Image: L. Oliveira Fernandes).

Creating reference resources to understand colour slide film

Developing a collection survey method for chromogenic film collections highlighted the need for establishing baseline information, including standardized terminology, and identification and assessment guidelines, all framed within a holistic perspective over these materials. Currently, no single source simultaneously integrates film identification and interpretation, illustrates common deterioration issues, provides preventive conservation guidelines and reliable treatment strategies, while considering the collection's specific content and context. Simultaneously, during the survey it was also noticeable how there is a scarcity of reliable references for dating and characterising films produced by other companies other than Kodak. In turn, they become more challenging to understand. Systematised reference materials – such as diagrams, tables, posters, booklets and open-access online resources – are critical to improve understanding about chromogenic film photographs [1, pp. 298-303; 3; 7; 12; 37; 48-49]. Such resources can also help raise the general public's awareness, and further support heritage professionals to advocate for their preservation. The long-term goal of this project is to utilize the collected data and images collected during surveys as reference that strengthen connoisseurship around colour slide film [1, pp. 186-189, 192-193, 200, 203-205, 298-303; 3; 7; 12; 37; 48-49]. Currently, the most efficient photograph conservation didactic tools are those that provide images of various objects in a standardized way and combine it with comprehensible text (such as Graphics Atlas) [7]. However, such resources must be designed with long-term sustainability, as they can quickly become obsolete if not planned with intended longevity at their core. Recently, a key resource for identifying and dating colour slide film has become inaccessible, and its future availability is uncertain [12, 50].

Conclusions

The methodologies utilized so far in this project have made it clear that there are many aspects about colour slide film that still need to be explored, both through its materiality and context. Although much invaluable information still needs to be collected, the feedback obtained through online surveys provided a glimpse into the societal pertinence of these materials. Alongside online surveys, interviews with stakeholders will be a very important source of knowledge in the next phase of research.

The opportunity to select and examine case studies in various types of organizations made it clear that colour slide film collections that became part of the holdings of Portuguese institutions is diverse and has much research potential. As issues affecting colour slide film can be slowed down in appropriate storage conditions, it is important to continue to advocate for the practical implementation of preventive conservation standards that benefit these objects in the long run. Nevertheless, it is equally vital to address common types of damage, as material change is intrinsically connected to a change in value. To address the complexity of these problems, colour slide film needs to be analysed in a comprehensive way, keeping in mind the how different conservation strategies relate to practical challenges, as well as to the profession's ethical guidelines.

Following these experiences, the next stages of the PhD these topics will be explored in more detail: 1) the impact of colour decay and the reproduction of contemporary artworks with colour slide film; 2) the re-evaluation of treatment methodologies that address common issues such as mould growth; 3) the development of reference tools for a better understanding of colour slide film collections, helping create training materials. Because this type of photographs can be found and continues to be relevant in many contexts and regions, the project's overall output will not only be relevant to collections in Portuguese institutions, but in the care of photograph collections in other parts of the world.

Acknowledgements

The authors would like to thank the financial support of the Fundação para a Ciência e Tecnologia (PhD scholarship ref. 2022.13036.BDANA). Furthermore, the support of the Biblioteca de Arte e Arquivos, Fundação Calouste Gulbenkian; Department of Conservation and Restoration, NOVA School of Science and Technology; Museus e Monumentos de Portugal, E.P.E. (Arquivo de Documentação Fotográfica, Coleção de Arte Contemporânea do Estado, Museu Nacional de Arte Contemporânea – Museu do Chiado); and the Museu Nacional de História Natural e da Ciência, Universidade de Lisboa. A thank you goes out to the NOVA FCT conservation students involved in the survey, all the participants of the online survey and those who continue to encourage this project.

REFERENCES

1. Pénichon, P., *Twentieth-century color photographs: identification and care*, Getty Conservation Institute, Los Angeles (2013).
2. Lavédrine, B., *A guide to the preventive conservation of photographic collections*,; transl. S. Grevet., 2nd ed., The Getty Conservation Institute, Los Angeles (2003), <https://www.getty.edu/publications/resources/virtuallibrary/9780892367016.pdf> (accessed 2024-11-22).
3. Lavédrine, B.; Gandolfo, J.-P., Frizot, M.; Monod, S., *Photographs of the past: process and preservation*, transl. J. McElhone, The Getty Conservation Institute, Los Angeles (2009).
4. Shanebrook, R. L., *Making Kodak film: the illustrated story of state-of-the art photographic film manufacturing*, 2nd ed., Robert L. Shanebrook, Rochester (2016).
5. Wilhelm, H., *The permanence and care of color photographs: traditional and digital color prints, color negatives, slides, and motion pictures*, Preservation Publishing Company, Grinnell (1993), http://www.wilhelm-research.com/pdf/HW_Book_761_Pages_HiRes_v1c.pdf (accessed 2024-11-01).
6. Image Permanence Institute, *Graphics atlas*, <http://www.graphicsatlas.org/> (accessed 2024-11-01).
7. Pavão, L., *Conservação de coleções de fotografia*, Dinalivro, Lisboa (1997), https://www.lupa.com.pt/site/index2.php?cont_=ver2&id=274&tem=160 (accessed in 2024-11-01).
8. Pietsch, K.; Oliveira Fernandes, L., 'Mouldy matters: conserving Ed van Der Elsken's 42.000 colour slides', in *Topics in Photographic Preservation* **18** (2019) 167-180, <http://faic.wpenginepowered.com/pmg-topics/wp-content/uploads/sites/9/2022/11/T18-167-180-Pietsch-Formatted.pdf> (accessed in 2024-11-01).
9. 'Colour Reversal', in *Fujifilm* (2024), <https://www.ishootfujifilm.com/products/category/color-reversal>.
10. Sommermeyer, B.; Haafte, C. v.; Weidner, T.; Kölle, B.; Pietsch, K.; Oliveira Fernandes, L.; Haidvogel, M.; Werner, B. M.; Caianiello, T.; Leonelli, F.; *Back to the future: riding the slide carousel = Back to the future: Im Karussell Der Diakonservierung*, Kerber, Hamburg (2019).
11. Assmann, J., 'Communicative and cultural memory', in *Cultural memory studies: an international and interdisciplinary handbook*, eds. A. Erll & A. Nünning, De Gruyter, Berlin and New York. (2008) 109-118.
12. Zbinden, E., *Historische Kleinbildfilm Datenbank*, <https://web.archive.org/web/20230923044734/http://bilderdienst.ch/> (accessed 2023-09-23).
13. Keene, S., 'Audits of care: a framework for collections condition surveys', in *Storage papers given at a UKIC Conference Restoration '91*, eds. M. Norman & V. Todd, United Kingdom Institute for Conservation of Historic and Artistic Works of Art, London (1991) 6-16, <http://www.suzannekeene.com/articles/AuditsOfCare.PDF> (accessed 2024-11-14).
14. Johnsen, J. S., 'Introduction to the surveyor's guide to condition assessment of photographic collections', in *ICOM-CC 12th Triennial Meeting Preprints*, vol. II, eds. J. Bridgland & J. Brown, James & James, London (1999) 555-560 <https://www.icom-cc-publications-online.org/2445/Introduction-to-the-surveyors-guide-to-condition-assessment-of-photographic-collections> (accessed 2024-11-16).
15. Casella, L., 'Photograph collections survey', in *Advanced Residency Program in Photograph Conservation*, George Eastman House and the Image Permanence Institute, Rochester (2007), https://www.conservation-wiki.com/w/images/7/7f/Casella_2007_Collection_Survey.pdf (accessed 2024-11-01).
16. Santos, J. L. da S., *Ángelo de Sousa's photographic and film collection: strategies for the preservation of colour slide-based artworks*, PhD dissertation, Department of Conservation and Restoration, Universidade Nova de Lisboa, Caparica (2019), <http://hdl.handle.net/10362/87080> (accessed 2024-11-14).
17. Oliveira Fernandes, L., 'Interpreting 35mm chromogenic slide film: the Ed van Der Elsken case-study', in *Colour photography and film: sharing knowledge of analysis, preservation, conservation, migration of analogue and digital materials - conference proceedings 001*, eds. B. Cattaneo, M. Picollo, F. Cherubini & V. Marchiafava, Gruppo del Colore – Associazione Italiana Colore, Milano (2021) 14-21, <https://doi.org/10.23738/RCASB.001>.
18. Kramer, L.; Nichols, A.; Anderson, M.; Kennedy, N. W.; Ramírez-López, L.; Wharton, G., 'Conducting a time-based media conservation assessment and survey at The Metropolitan Museum of Art', *Journal of the American Institute for Conservation* **60**(2-3) (2021) 236-54, <https://doi.org/10.1080/01971360.2020.1855866>.
19. Río, V. del; Gómez-Isla, J., 'Introduction: photography in the Iberian context', *Photographies* **13**(1) (2020) 3-6, <https://doi.org/10.1080/17540763.2019.1707476>.
20. Oliveira Fernandes, L., '[1] Colour slide film | General', in *Microsoft Forms*, DCR NOVA FCT (2023), <https://forms.office.com/e/e1kbXEgC15> (accessed 2024-11-05).
21. Oliveira Fernandes, L., '[1] Slides a cor | Geral', in *Microsoft Forms*, DCR NOVA FCT (2023), <https://forms.office.com/e/19uPtaK6e6> (accessed 2024-11-05).
22. Nishisato, S., 'Data analysis and Likert scale', in *Measurement, mathematics and new quantification theory*, ed. S. Nishisato, vol. 16, Springer, Singapore (2023) 19-36, https://doi.org/10.1007/978-981-99-2295-6_2.

23. Fredheim, L. H.; Khalaf, M., 'The significance of values: heritage value typologies re-examined', in *International Journal of Heritage Studies* **22**(6) (2016) 466-481, <https://doi.org/10.1080/13527258.2016.1171247>.
24. Ayhan, H. Ö., 'Non-probability sampling survey methods', in *International Encyclopedia of Statistical Science*, ed. M. Lovric, Springer, Berlin and Heidelberg (2011) 979-982, https://doi.org/10.1007/978-3-642-04898-2_41.
25. Calouste Gulbenkian Foundation, 'Espólio do Estúdio Horácio Novais', in *Biblioteca de Arte Gulbenkian*, Biblioteca de Arte e Arquivos, Lisboa (1927-1988), <https://www.bibartepac.gulbenkian.pt/ipac20/ipac.jsp?&profile=ba&uri=full=3100024-!284047-!0> (accessed 2024-11-02).
26. Instituto de Investigação Científica Tropical, 'Jardim Botânico Tropical', in *Arquivo Científico Tropical Digital Repository*, Arquivo Histórico Ultramarino, Lisboa (1929-c. 1990), <https://actd.iict.pt/collection/actd:AHUJBT> (accessed 2024-11-02).
27. Luis Pavão, Ltd., 'Arquivo do Instituto Português de Conservação e Restauro. Projeto de digitalização e tratamento de 15000 espécies fotográficas. Relatório final', report, Luis Pavão, Ltd., Lisboa (2004).
28. Coleção de Arte Contemporânea do Estado, 'Augusto Alves da Silva, *Estradas em Obras*, 1997', in *Coleção de Arte Contemporânea do Estado*, Coleção de Arte Contemporânea do Estado, inv. SC 1312, <https://colecciondoestado.pt/sc-1312/> (accessed 2024-11-02).
29. Museus e Monumentos, E.P.E, 'João Tabarra, Les revolutionnaires et la strip' teaseuse, 2000', in RAIZ, Museu Nacional de Arte Contemporânea – Museu do Chiado, inv. 2420, <http://raiz.museusemonumentos.pt/DetalhesObra?id=203453&tipo=OBJ> (accessed 2024-11-02).
30. Museus e Monumentos, E.P.E, 'Pedro Paiva e João Maria Gusmão, O Grande Jogo, 2005', in *MSoftware database record*, Museu Nacional de Arte Contemporânea – Museu do Chiado, inv. 2617.
31. Waldthausen, C. C. v., *Coatings on 19th century paper photographs: guidelines for identification*, Master dissertation, Conservation and Restoration, Universiteit van Amsterdam, Amsterdam (2014).
32. Roldão, É. C. T. C., *A contribution for the preservation of cellulose esters black and white negatives*, PhD dissertation, Department of Conservation and Restoration, Universidade Nova de Lisboa, Caparica (2018), <https://run.unl.pt/handle/10362/59914> (accessed 2024-11-01).
33. Frost, H., 'Surveying sound recording collections', in *Sound savings: preserving audio collections. Proceedings of a symposium sponsored by School of Information, Preservation and Conservation Studies, University of Texas at Austin Library of Congress National Recording Preservation Board Association of Research Libraries Austin*, ed. J. Matz, Association of Research Libraries, Austin (2003) 43-59, <https://www.arl.org/wp-content/uploads/2004/12/sound-savings.pdf> (accessed 2024-11-14).
34. Luis Pavão, Ltd., 'CFT164_Backup', in *Microsoft Access database*, Luis Pavão, Ltd. and Calouste Gulbenkian Foundation, Lisboa (2000-2018).
35. Museu Nacional de História Natural e da Ciência, *Inventário das coleções fotográficas - IICT. Jardim Botânico Tropical*, Microsoft Excel file, Museu Nacional de História Natural e da Ciência (2011).
36. Luis Pavão, Ltd., 'Base de Dados Fotografia_03ut11', in *Microsoft Access database*, Luis Pavão, Ltd., Lisbon and Arquivo Documental de Fotografia, Sacavém (2003-2004).
37. Layton, J., 'Eastman Kodak', in *Physical characteristics of early films as aids to identification: new expanded edition*, 2nd ed., ed. C. Blot-Wellens, FIAF - International Federation of Film Archives, Brussels (2020) 229-256, https://www.academia.edu/44628548/Eastman_Kodak (accessed in 2024-11-01).
38. Lourenço, M. J. L.; Sampaio, J. P., 'Microbial deterioration of gelatin emulsion photographs: a case-study', *Topics in photographic preservation – American Institute for Conservation* **12** (2007) 19-34, http://resources.conservation-us.org/pmgtopics/2007-volume-twelve/12_06_Lourenco.pdf (accessed 2024-11-14).
39. Thyss, E., 'Étude de l'effet de quelques solvants sur des films inversibles couleur des années 1950 Kodak Ektachrome 6101 (lumière du jour) et 6102 (lumière artificielle)', *Support | Tracé* (17) (2017) 91-100, https://www.academia.edu/3676717/Etude_de_l_effet_de_quelques_solvants_sur_des_films_inversibles_couleur_des_ann%C3%A9es_1950_Kodak_Ektachrome_6101_Lumi%C3%A8re_du_jour_et_6102_Type_B (accessed 2024-11-21).
40. United Nations, 'Standard country or area codes for statistical use (M49). Geographic regions', in *United Nations - Department of Economic and Social Affairs*, <https://unstats.un.org/unsd/methodology/m49/> (accessed 2024-11-29).
41. Oliveira Fernandes, L.; Roldão, É.; Tavares, E.; França de Sá, S., 'Fading memories: assessing colour slide film's cultural impact in Portugal and abroad', in *Colour photography and film: sharing knowledge of analysis, preservation, and conservation of analogue and digital materials 2024*, vol. 13, eds. A. Plutino, B. Cattaneo & M. Picollo, Gruppo del Colore - Associazione Italiana Colore, Milano (2025), <https://doi.org/10.23738/RCASB.013>.
42. Marchesi, M., *Forever young: the reproduction of photographic artworks as a conservation strategy*, PhD dissertation, Leiden University Centre for the Arts in Society, Universiteit Leiden, Enschede (2017), https://s3-eu-west-1.amazonaws.com/production-static-stedelijk/images/_verdieping/Onderzoek/science4arts/M.%20Marchesi_Forever%20Young.pdf (accessed 2024-11-16).
43. García Celma, M., 'Reproduction and the attribution of authenticity in the conservation of contemporary photography: Thomas Ruff's portrait *Pia Stadtbäumer* at Museum Für Moderne Kunst, Frankfurt', *Artmatters International Journal for Technical Art History* **SI 1** (2021) 23-29, https://www.amjournal.org/_files/ugd/14a82d_29f782482d6a4457a47db550c7143e79.pdf (accessed 2024-11-16).
44. Alves da Silva, A.; Dijkstra, R.; Hartley, A.; Shonibare, Y.; Smith, P.M.; Pinhorn, A.; Dunlop, I.; Bracewell, M.; Hubbard, S.; *The Citybank private bank photography prize 1999*, The Photographers' Gallery, London (1999).
45. Stigter, S.; Touber, J., 'Oral history: stories at the museum around artworks. The challenges of sharing interview recordings in a FAIR way', in *History, Culture, and Heritage, AHM Conference 2024: "Heritage, Memory and Material Culture"*, eds. I. Saloul, S. Berrebi, N. Munawar & M. Panico, Amsterdam University Press, Amsterdam (2024) 9-16, <https://doi.org/10.5117/9789048567638/AHM.2024.002>.
46. Lucas, C.; Hill, G.; Binnie, N. E., 'Disinfection of photographic materials with ethanol vapours: preliminary evaluation of the effects on chromogenic prints', *Journal of the Canadian Association for Conservation* **45** (2020) 29-50, <https://photographconservation.ca/wp->

- [content/uploads/2024/10/LUCAS-et-al_2020_Disinfection-of-photographic-materials-with-ethanol-vapours-Preliminary-evaluation-of-the-effect-on-chromogenic-prints.pdf](#) (accessed 2024-11-21).
47. Taylor, J., 'Intra-surveyor bias in collection condition surveys', in *ICOM-CC 16th Triennial Conference Preprints*, International Council of Museums – ICOM, Paris (2011) 1-9, https://www.icom-cc-publications-online.org/dlfile.aspx?file=docs/content/pdfs/2011/ICOM-CC_2011_Lisbon_399.pdf (accessed 2024-11-14).
 48. Valverde, M. F., *Photographic negatives. Nature and evolution of processes*, Image Permanence Institute / George Eastman House, Rochester (2005), https://s3.cad.rit.edu/ipi-assets/publications/negatives_poster_booklet.pdf (accessed 2024-11-21).
 49. Weaver, G., *A guide to fiber-base gelatin silver print condition and deterioration*, George Eastman House, International Museum of Photography and Film Image Permanence Institute, Rochester Institute of Technology, Rochester (2008), https://gawainweaver.com/images/uploads/Weaver_Guide_to_Gelatin_Silver.pdf (accessed 2024-11-14).
 50. Oliveira Fernandes, L.; Zbinden, E., 'Bilderdienst.ch website', personal communication via email, (February 17-21, 2024).

RECEIVED: 2024.12.1

REVISED: 2025.10.10

ACCEPTED: 2025.11.6

ONLINE: 2026.4.13



This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License. To view a copy of this license, visit <http://creativecommons.org/licenses/by-nc-nd/4.0/deed.en>.