THE PRESERVATION AND CARE OF PHOTOGRAPHIC RECORDS IN HERITAGE COLLECTIONS WITH REFERENCE TO THE PHOTOGRAPH COLLECTION OF THE ALAN PATON CENTRE AND STRUGGLE ARCHIVES [1]

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Abstract

It is not unusual for libraries and heritage institutions to include photographic records and collections in their archival holdings. The short history of photography reveals that a range of different materials, chemicals and processes are involved in capturing photographic records, indicating the chemical complexity of the different photographic types and film. To ensure their longevity, photographic records and materials require stringently applied preservation measures and correct storage methods as their chemical make-up is prone to deteriorate rapidly if environmental conditions are not optimal and storage enclosures are ill-considered. Also, records can easily be damaged through incorrect handling, storage and display methods.

The current preoccupation with digitisation and the availability of digital imagery has opened up the discourse of the preservation of conventional photographic records. As conventional photographic records, equipment and materials seem to be disappearing, making way for digital technologies, the need for the physical preservation of conventional photographic materials has come to the fore. To ascertain suitable preservation, handling and storage methods for photographic records, this article will outline briefly the chemical make-up of photographic records as found in the Alan Paton Centre and Struggle Archives at the University of KwaZulu-Natal in South Africa; discuss the identification of different film types represented in this collection; examine causes of deterioration and damage; and will *recommend suitable preservation and storage methods and systems to assist in prolonging the life of these photographic records. Some observations on the usefulness of digitisation as an effective preservation tool will conclude the article.*

Keywords: Digitisation, Photographic Records, Preservation

Introduction

The Alan Paton Centre and Struggle Archives on the Pietermaritzburg campus of the University of KwaZulu-Natal holds a collection of late nineteenth and early twentieth century black and white photographic prints and their negatives; mid- to late twentieth century colour prints and their negatives, black and white and coloured transparencies and slides, sheet film and microfilm. The formulation of a reliable preservation programme for these photographs and their negatives required a general knowledge of the chemical make-up of the various types of photographs and film; an understanding of the factors causing damage and deterioration; and knowledge about preservation methods and suitable storage systems for photographic materials. In addition, Roosa and Fellow's (1992:1) suggestion that good collections management forms part of the preservation of a photograph collection, was accepted. In their view, an inventory is necessary to ascertain which photographic processes are represented in the collection; which photographs are mounted; which are unmounted; and which are in albums. They also recommend that an assessment of the storage and preservation needs of photographs be done. The cataloguing, documentation and accessioning are important aspects of a preservation plan, as easy access reduces the unnecessary handling of photographs, and facilitates returning them to their correct places. Such a proactive, preventative plan can radically prolong the life, not only of photographs but, of other archival materials as well. The Alan Paton Centre and Struggle Archives has devised their own system, which has effectively reduced the handling of photographs to only a few times per year (see Liebenberg-Barkhuizen 2005). Also, a good management system requires photographs to be cleaned, treated if insect or mould infestation is indicated and repaired by a suitably qualified conservator prior to absorbing them into the collection, thereby ensuring safekeeping.[2]

The structure of a photograph

Many image-forming processes[3] have been developed since the invention of photography in France in the beginning of the nineteenth century, underlining the importance of knowledge about the nature of the different photographic materials by staff responsible for photographic records. However, all photographic[4] images share a basic, common structure. The National Archives of Australia (1999:91) explains that a photograph is formed through an image obtained through light being projected onto a base material which could be glass, paper or film, which has been coated with a light sensitive material in the form of an emulsion (also referred to as the binder), which is usually albumin or gelatine with silver halide salts[5] to make black and white images, or pigments and dyes to form colour images. This image is then developed and fixed using various chemicals. A photograph which is printed on paper usually requires a negative, made either of glass or, since the twentieth century, flexible film, whereas a transparency or slide is a positive image and requires no negative, but needs light to be projected through the image for it to become visible.

A consideration of the history of photography will reveal that a variety of processes were followed involving a number of chemicals, thereby making photographs complex structures to preserve. The discovery of photography, dated generally to 1839 (Scharf 1974:13), went hand in hand with the development of naturalism in art. Prior to the invention of the camera, and as early as the beginnings of the Renaissance, artists have made extensive use of the camera *obscura*[6] and camera *lucida*[7] to ensure accurate representation of landscapes and portraiture. Already by the early 1820s, photographic images were available, although not permanent, due to the experiments of Louis Jacques Mandè Daguerre and Joseph Niépce.[8] They used iodene and mercury to obtain images, but when Daguerre used sodium thiosulphate in 1837 as a fixative, he managed to make the first more or less permanent photographic image (Scharf 1974: 25). Further experiments to create photographic images were conducted by William Henry Fox Talbot in 1839 (National Archives of Australia 1999:95), who used silver nitrate and sodium chloride to sensitise paper to light. The various experiments lead during the

1850s to different methods of creating photographic images, notably "albumen printing-out paper and the wet collodion process" (National Archives of Australia 1999:95), thereby establishing the basis for a flourishing new form of visual record-taking. Albumen printing made us of egg-white, rendering it susceptible to deterioration and decay. Nevertheless, this method, along with the collodion invention of Frederick Scott Archer in 1851(National Archives of Australia 1999:96), became the most popular forms of photographic printing in the latter half of the nineteenth century. The collodion process used glass as a base, rendering this form of photography equally fragile, as breakage can occur. During the 1870s, gelatine was introduced as an emulsion to carry silver particles, and remained popular for a variety of applications well into the twentieth century.

While these nineteenth century photographs did not make use of film as we have come to know it during the late twentieth century, the discovery of synthetic plastic in 1869 laid the foundation for further development of transparent film (Bereijo 2004:324). This plastic—or celluloid—was the medium for photographic processing developed by J Carbutt and G Eastman Kodak, who began to sell the first cellulose nitrate negatives in 1889 (Fischer 2004:1). Later in the nineteenth century the Lumière brothers, August and Louis, made cinematic projection possible through the use of a cellulose nitrate film, but this film tended to curl and was highly flammable (Bereijo 2004:324). Despite the shortcomings and instabilities of this film, it remained popular until the 1950s (Fischer 2004: 1).

The early twentieth century saw the next development: safety film or acetate film during the 1930s and later, cellulose diacetate (National Archives of Australia 1999:1). The advantage of this film was a reduced risk of flammability[9] but high humidity absorption, fading of colours and tones and sensitivity to contraction posed problems in terms of its longevity. This, Bereijo (2004:324) says, led in 1947 to the use of cellulose triacetate film, which is still available.[10] Triacetate film is also not a stable film but is not as flammable as nitrate film.

Although colour photography has been possible as early as the late nineteenth century (Time Life 1981:42)[11] it was only in 1922 when a stable process was developed (Bereijo 2004:324). Until this time, black and white images prevailed. Colour photography, as is the case with black and white photography, developed through experimentation with a number of processes using an array of materials including potato starch, gelatine, silver chloride, and citric acid. Technicolour developed between 1933 and 1950 and in 1952, Kodak's Eastmancolor negative was produced thereby opening up the field for cheaper, more readily available developments into colour photography (Bereijo 2004:324). The introduction of polyester[12] film in the mid 1950s ensured greater stability and durability. However, black and white images printed onto a paper base are quite stable and generally last longer than the more recent colour images, particularly Polaroid (Shenise 1997:1).

Identification of photographic supports

Photographs are usually printed on paper following a number of chemical processes, but glass has also been used and since the invention of celluloid, film. These two materials are easily identified. Glass is the most stable material used as a base, but is prone to breakage and therefore requires specific storage methods to prevent such damage. Paper is less stable as wood pulp, introduced to paper-making during the late nineteenth century, could react with the chemicals used in the making and processing of the photographic image, causing it to fade and discolour. This means that preservation procedures valid for paper are also valid for photographs, but the chemical composition of photographs, in addition to its paper base, complicates its preservation needs.

The so-called 'plastic' negatives are not that easily distinguishable, though, and are not as stable as glass. Nitrate negatives can be recognised, according to Fischer (2004:1-2), from the edge printing by manufacturers, which denotes whether the film is 'safety' or 'nitrate'. This marking does not occur on all negatives, but the tendency to curl is a certain identification of nitrate film[13] as is the 'V' notch (Bennett and Johnson 1999:2) used by Kodak prior to 1949 (Fischer 2004:1-2). Professional nitrate film does not curl but also has a notch as identification (Fischer 2004:2).[14] Further, Eastman Kodak films are the only kind bearing a date, whereas some nitrate film, presented as sheets, will carry negative numbers, usually from 1 to 12 (Fischer 2004:2). Another identification method is that nitrate film produces nitric oxide, nitrous oxide and nitrous dioxide which combined with moisture in the air will form nitric acid (Fischer 2004:2) which erodes the film and its enclosures. Cellulose nitrate film is chemically unstable and is, as will be seen, highly combustible. Safety or acetate film, which is composed of any of the mixed esters – cellulose acetate propionate or butyrate (Eaton 1970: 86) – or cellulose diacetate or triacetate, can be identified by edge markings containing the word 'safety' and it may further have a 'U' shaped notch along the edge (Bennett and Johnson 1999:1). Film can also be tested[15], but these processes can damage the film (Fischer 2004: 3) and should only be conducted by trained staff under controlled conditions.

Chemical deterioration and damage

The National Archives of Australia (1999:92) identifies the two main types of deterioration of photographic prints as "sulphiding" and "oxidation-reduction". "Sulphiding" refers to the process of silver interaction with sulphur. Sulphur is present in polluted atmosphere in the form of hydrogen sulphide, in the developer and fixer (usually sodium thiosulphate) used during processing film; in black so-called 'photographic paper', and in a variety of paper products. Sulphide damage is characterised by yellowing, fading, and loss of detail. Oxidation-reduction is, according to the National Archives of Australia (1999:93) the main cause for etrioration of silver-based photographs. This process refers to the oxidising of silver particles to produce silver ions, which cause the characteristic silver mirroring often found in black and white prints.

Paper forms the base of most commonly held photograph collections in South African archival institutions, and is also the case with the photograph collection of the Alan Paton Centre and Struggle Archives. Deterioration patterns of paper must hence also be observed when dealing with the preservation of photographs printed on paper. Eaton (1970: 86) noted a link between the yellowing of photographic imagery and the nature of the paper base employed. He further noted research conducted into the use of purified wood pulp paper and suitable sizing as permanent (Eaton 1970: 87). This may explain the stability of most twentieth century black and white silver halide prints on paper. In addition, as the main component of film is generally gelatine, which is an organic, animal product, it is inevitably prone to deteriorate because soluble in water. Due to its organic nature, it also attracts insects and offers cultivation ground for a variety of fungi. Bereijo (2004:325) records that the emulsion of film and its base have different contraction and expansion rates, thereby making it prone to flaking.

Seaton (1982:129) claims that the main cause for deterioration of film lies in the chemical residues left in the material after processing the film, usually fixer or thiosulfate (Roosa and Fellow 1992:6) indicating agreement with the National Archives of Australia insofar as 'suphiding' is concerned. The damage caused can go undetected as deterioration occurs over time and as there are no visible indicators of poorly developed or fixed photographs. Eaton (1970: 86–93) presents a detailed description of the developing and fixing process of silver halide prints, emphasising the chemical conversion of exposed silver halide into the metallic silver image, and of the unexposed silver halide into soluble silver-hypo compounds. The inadequate washing of processed images can leave a residue of silver hypo compound on the print, which can cause a characteristic brown staining of the image and create the appearance of tarnishing. However, well-monitored processing can result in stable photographic images. The presence of chemical residues on photographic prints can also cause the image to fade or to develop stain-like marks (National Archives of Australia 1999:2). Eaton (1970: 86) suggests that knowledge of photographic processing is therefore indicated in the preservation of photographic collections.

Destructive chemicals can furthermore also be present in the atmosphere surrounding the film, or in the enclosures chosen to house the film. Due to their chemical make-up, photographic materials are therefore also sensitive to chemicals such as sulphur dioxide, hydrogen peroxide, a variety of detergents, paints and varnishes, insecticides, and carbon monoxide.

Nitrate film

Nitrate film is, essentially and by nature, unstable and highly combustible and flammable, though this hazard seems to exist mainly in motion picture film. Bereijo (2004:325) further describes the deterioration processes of nitrate film: deterioration of film generates energy and gaseous by-products such as nitric oxide and nitruous dioxide which encourage further deterioration and speed up the process. Nitrate film is best removed from its containers to allow such gases to be ventilated. In its deterioration, which is quick, nitrate film passes through a number of progressive phases (Fischer 2004:3):

i. No deterioration is evident.
ii. Yellowing and mirroring becomes evident in negatives.
iii. The film becomes brittle and sticky. Nitric acid is emitted which causes a characteristic odour; the image is still legible (Fischer 2004: 2) and the film should be reproduced or reformatted no later than this stage.
iv. The image fades and colour turns amber. Bereijo (2004: 325) records that the film can cause bubbling at this stage and that the odour becomes evident only at this stage.
v. The film becomes soft and can adhere to adjacent film and enclosures.
vi. The film disintegrates into a brownish powder.

The greatest threat posed by deteriorating nitrate film is hence the danger of fire. Spontaneous combustion of nitrate film can occur at temperatures as low as 41°C (Bereijo 2004:326).[16] Deteriorating nitrate film produces nitric acid, nitric oxide and nitrogen dioxide, chemicals which are destructive and which can affect other photographic materials. These chemicals are also dangerous to the health of those who handle such materials, requiring well-ventilated areas and suitable protective clothing. Contact lenses should not be worn while working with these materials (Bereijo 2004: 325). Nitrate film should be stored in buffered paper (not in plastic enclosures), in a well-ventilated room at the prescribed temperature and relative humidity and separated from the rest of the collection (Roosa and Fellow 1992:8).

Cellulose acetate film

Acetate film or 'safety film' does not hold the fire hazard of nitrate film but remains, nevertheless, unstable. The deterioration of cellulose diacetate film is detectible through the presence of a strong acidic odour, known as the 'vinegar syndrome' (National Archives of Australia 1999: 2), which indicates the presence of acetic acid. Acetate film also becomes brittle, the film base can produce bubbles and crystals and produces small waves in the process of deterioration, which Bereijo (2004:326) calls the "channelling effect". This is caused by adverse storage and environmental conditions. Acetate film also deteriorates autocatalytically and should hence be removed from the collection and stored separately. Polyester film has replaced acetates as it is more stable and can be used for a variety of film and photographic products. Its edge markings 'Estar' or 'Cronar' indicate that the film is made of polyester (Bennett and Johnson 1999:2). A complication which arises from deteriorating nitrate and acetate film is that it should be reformatted as soon as possible, particularly since such deterioration happens quickly and often goes unnoticed.

Common types of physical damage

Aside from chemical deterioration, photographic materials can suffer other, physical forms of damage, usually due to poor handling and neglect. As photographs are usually printed on paper, tears, folds and creases can result from poor handling. The paper base and gelatine emulsion are attractive food sources for a variety of pests, which can cause irreparable damage to photographs. Tears can cause the emulsion to split and separate from the paper. Rough handling of photographs can also result in creasing the photograph, as is the case with paper and can cause the emulsion to split (Palfreyman 1998:70). The smooth surface created by albumen and gelatine (Palfreyman 1998:70) is also prone to scratching as a variety of abrasive particles can be found in the atmosphere and between papers and photographs. Vogt-O'Connor (1997a:3) warns against attempts to flatten buckled card mounts, and to remove historic images from their albums and mounts – instead, correct storage procedures for these should be followed. Also, she states that older type photographs are often severely damaged due to archivists attempting to disassemble the casings of Daguerrotypes and Ambrotypes, or to force them to open or close (Vogt-O'Connor 1997a:2). Conservators also warn archivists and librarians not to exert pressure onto the back of the photographs when writing onto the paper surface, as indentations can occur.

Environmental factors affecting photographic materials

From the above it is clear that the chemical composition of photographs, as well as their physical make-up can be damaged due to rough handling and poor storage and environmental conditions. Film that shows signs of deterioration should be immediately isolated from the remainder of the collection. While film in the early stages of deterioration is still usable, these should immediately be copied (Bereijo 2004: 325) to preserve the image. Only qualified staff should handle deteriorating film and should make proactive decisions regarding further steps to take.

Environmental factors such as temperature, humidity, light and polluted air can, if not controlled and monitored daily, have an adverse effect on film ad photographic prints and collections should be protected from insect and mould infestation. Photographs should ideally be stored in cold, dark, unpolluted and climatically controlled spaces. As most photographs have a paper base, it is important to bear this in mind when ascertaining suitable temperature and humidity levels. As is the case with paper, fluctuations in relative humidity and temperature should be kept to a minimum, as emulsions can be detached from their bases (Palfreyman 1998: 74). Environmental factors which affect photographic materials are:

1. Relative Humidity (RH): This is the "single most important factor in preserving most photographic material" (Norris 1992:1). High RH causes a softening of gelatine in film (Bereijo 2004:326) hence inducing mechanical damage. Through hydrolysis, the film can therefore be destroyed. Too low RH is likewise damaging, as this can cause the gelatine to become brittle and break, causing the emulsion to separate from the base.

Roosa and Fellow (1992:4) recommend that RH levels for collections holding slides, prints and negatives be kept stable at 30%-50%, whereas 30%-40% would be suitable for photographs only. The National Archives of Australia (1999:4) recommends that black and white photographs be stored at 8-12°C at 30%-40%RH and colour images at less than 5°C at 30% -40%RH. However, historic glass plates, nitrate and acetate film will continue to deteriorate at higher levels. Both nitrate and 'safety film' should be kept at 20%-30%RH, and glass plates at 30%-35%RH. It is also important to note that fluctuations in temperature and RH known as 'cycling' (Roosa and

Fellow 1992:3) can cause structural damage to film and should hence be kept at the minimum.

2. Temperature: Chemical processes generally require heat to accelerate. High temperatures will therefore accelerate the deterioration of film. In the presence of high humidity and temperature, polluted air is especially damaging to silver images as they tend to oxidise and colours tend to fade (Roosa and Fellow 1992:3). High temperature and humidity provide an attractive atmosphere for mould spores and other micro-organisms to grow, particularly on the gelatine emulsion, and the enzymes they secrete destroy the emulsion therefore also the image it contains (Bereijo 2004: 327). The damage caused by mould growth is extreme, and in the case of slides and transparencies, can destroy the photograph if not treated immediately. The vinegar syndrome, as well as fading of dyes, is caused by high temperatures. It is therefore recommended that film should be stored at the lowest possible temperature.

3. Light: All film is by nature sensitive to light and hence prone to fading and discolouration. Well-processed black and white silver gelatine prints and their negatives are, according to Roosa and Fellow (1992:5) relatively stable and can tolerate light better than more sensitive, historic types of film and colour photographs. For these, LUX levels should be below 100, and Ultra-Violet (UV) levels should, for all photographic types, be avoided. Excessive exposure therefore causes film to fade, discolour, embrittle and disintegrate.

The effect of light on film and photographs is accumulative (Roosa and Fellow 1992:5), and damage can be calculated in advance, using a preservation indicator. Lux and UV levels should be eliminated and precautions taken not to expose film to light for any length of time. Tungsten light is preferred to fluorescent (Seaton 1992; 13:1) which contains high UV levels. However, it is best only to use light when viewing photographs and this should be kept low – less than 50 Lux brightness and about 30µW/lm (Palfreyman 1998: 84). UV filters are readily available for fluorescent lights and should be used.

4. Pollution: Air quality in any city contains smoke, dust and other harmful particles, oxidising gases and other pollutants emitted from motor car engines and industrial plants. Fossil fuels are known to

produce nitrogen oxide and nitrogen dioxide, which attack the chemical structure of silver compounds. Roosa and Fellow (1992: 4) state that nitrogen oxides and ozone[17] are the main culprits responsible for the decay of photographs.

Any airborne particulate matter can combine with pollutants from fossil fuels to form nitrogen and sulphur dioxide, which, in combination with moisture in the atmosphere, form nitric and sulphuric acid and settle on paper and film. This can cause a variety of erosions to the film from basic abrasions and silver mirroring to acid burns. Air-borne particles can fade black and white images, and 'off-gassing"[18] from fresh paint, plywood, deteriorating cardboard, and a variety of chemicals and detergents can damage paper and photographic materials (Norris 1992:1).

It can therefore be deducted that film should be stored at cold temperatures and low RH, and storage spaces and air quality should be clean. This means that air filtration systems are recommended for photographic storage areas to ensure and these systems require regular maintenance to operate effectively. It is also important that, while storage spaces should be kept clean to avoid pollutants, particulate matter and insects from entering photographic collections, precautions should be taken to avoid contamination from and contact with damaging chemicals.

The storage and handling of photographs

Storage systems for photographic collections[19] should bear in mind the chemical composition of photographic prints, negatives and film. This will determine the type of enclosures to house photographic prints, negatives and other photographic materials, and will also determine whether materials will be stored vertically, horizontally, or rolled up.

The chemical structure of photographs can further be protected from damage incurred by high temperatures and humidity, insect and mould infestation, light and poor air quality through selecting suitable enclosures and following prescribed storage methods. The creation of microclimates and layered storage (Palfreyman 1989: 75) offer effective protection against light, fluctuations in RH, and pollutants in the air, and have the added advantage of protection during disasters. At the Alan Paton Centre and Struggle Archives, photographs are protected through multiple layers: individual Mylar sleeves holding the smaller photographs are grouped within a folder, which is kept in a hanging file within a powder-coated cabinet. In this way, photographs are protected from light and the atmosphere, and the cabinet provides additional protection while allowing each drawer to establish its own microclimate.

A further consideration in selecting suitable storage systems lies in the fact that not all photographs, as is the case with paper or glass plates, are the same size. For this reason, stacking photographs of differing sizes on top of each other is undesirable as the pressure of the load can cause the emulsion of the larger photographs to crack and the differences in sizes will cause bending and curling. The paper bases can also tear and bend under the weight of a large pile of photographs. Glass plates can break and are best store vertically. The Alan Paton Centre and Struggle Archives designed their own system in which smaller photographs are suspended vertically in tailored Mylar sleeves (Liebenberg-Barkhuizen 2005: 59), while large and large mounted photographs are stored horizontally to prevent them from curling or bowing. The separating out of the different sizes of photographs may interfere with the records management system used by the archive, but location notes could be used to facilitate access and to retain a record of the order of mixed archival records.

Photographic items which are stored vertically could safely be supported by dividers (Palfreyman 1998: 75), which would reduce movement within the storage box/cabinet and allow photographs not to sag and curl. Movement can cause tears, folds and abrasions. It is also important that the furniture used for photographic collections be made of non-combustible and non-corrosive materials. Wood should be avoided as this can be acidic, whereas stainless steel and powder-coated steel are more suitable (Roosa and Fellow 1992:6)

Photographic enclosures

Photographic materials should be individually enclosed before placed within their storage boxes or cabinets. These enclosures protect the items from dust and dirt, which can introduce moisture to the surface of film and of photographic prints and which can scratch the emulsion of both photographic prints and their negatives and of film (Norris 1992:1). For photographic prints and their negatives, paper enclosures have the advantage in that they are opaque and add protection against light, and they can be labelled directly using a soft pencil. It is, however, important that a suitable paper be used which will not affect the chemical make-up of the print or its negative. Polyester enclosures, on the other hand, hold an advantage for photographic prints as they are transparent, therefore reducing unnecessary handling due to the image and its inscriptions being visible through the plastic. The photograph therefore does not have to be removed from its enclosure to be viewed, reducing the potential damage resulting from fingerprints or from the incorrect use of cotton gloves. Proper labelling and an accurate record keeping system of photographic prints, negatives and other photographic materials will also facilitate access, reduce unnecessary handling and exposure to light and the atmosphere as the correct image can be located easily without having to search an entire collection.

Wrapping material for both black and white and colour photographic prints and their negatives should be chemically pure and inert and could be made of paper or plastic such as Mylar for prints and preferably paper for negatives. PH neutral (7.0 – 7.5) enclosures contain no acid but lack the capacity to absorb acid from the environment and from the photographs themselves (Albright 1993:1). They should be used with some caution.[20] Paper enclosures should be lignin free, 100% rag and not coloured (Albright 1993:2), free of sulphur, acid and peroxide, and should pass the Photographic Activity Test (PAT),[21] (Norris 1992:1). Unbuffered paper enclosures are better than buffered paper, as alkaline buffering, intended to absorb acidity in paper, can damage photographs (Derby 1997:2). Norris (1992:1) recommends buffered enclosures, which have a pH of 8.5, for brittle prints mounted on inferior quality card and for deteriorating negative film, but are not suitable for contemporary colour photographs. Film based negatives, on the other hand, should be kept in buffered enclosures. Whichever types of enclosures are used, care should be taken that adhesives used in the construction of the enclosure should not touch the photograph as this could affect the silver in the photograph (Roosa and Fellow 1992:7).

Plastic enclosures intended for photographic prints should be made of uncoated polyester, polypropylene or polyethylene, of which Mylar or Melinex are the most reliable. Polyvinyl chloride, or PVC, should be avoided as it contains chemicals which, through off-gassing, can damage the emulsion of the photograph. Negatives and film may adhere to polyester in high humidity, and should hence be avoided. The choice of enclosures is determined by the frequency of use, funding available and environmental conditions (Roosa and Fellow 1992:6).

Many museums and archives hold photograph albums. These pose a number of difficulties, as they are often made of acidic materials, and during the 1970s, so-called 'magnetic' albums introduced a form of glue, which stains black and white images and damages the paper base of some photographic prints. Where possible, photographs should be carefully detached from these pages, cleaned and transferred to a suitable album, recreating the original. Magnetic-type albums, as well as acidic albums are best reformatted and stored wrapped in acid-free tissue paper.

Handling photographs

Incorrect handling, transport and display can severely and permanently damage photographs. While it is generally recommended that lint-free cotton gloves be used to handle photographs, recent attitudes consider the damage which may result from using such gloves as residing, amongst others, in the sensitivity of the fingers being "obfuscated" (Baker and Silverman 2005: 6). Handling procedures are important to set up (Derby 1997:2) and should demand that photographs are viewed in clean areas, that hands be clean and good housekeeping rules be observed. Photographs should be carried correctly, that is, supported on a horizontal surface such as a tray and viewed lying flat on a table. Dropping a photograph could result in a corner cracking, causing the emulsion to split from its paper base. Also, as photographs are usually stored at cold temperatures, it is recommended that, particularly in warmer and humid climates, they should be allowed time to acclimatise before introducing them to the warmer research area or reading room, as condensation may occur, which can damage the surface of the image.

Colour prints, transparencies and slides

Coloured photographic materials are mostly unstable as they can fade under conducive conditions. The dyes used to obtain the image are usually of organic origin and hence prone to deterioration when exposed to light and poor air quality. Due to this unstable characteristic of colour photography, Roose and Fellow (1992:9) recommend cold storage at 20–40% RH to retard image loss. Patrick Ngulube[22] also recommends cold storage at very low temperatures of -5°C to -1°C. Colour slides are prone to mould attacks due to the chemical nature of their film base and the usual, commercially available storage enclosures prior to their arrival at the archives. Slides are also very sensitive to UV light and it is best not to expose them for long periods to light, not even while viewing them through a projector.

Conclusion: digitisation as a preservation method

The volatile and delicate nature of photographic materials indicates that special care should be taken in their preservation. It is imperative that staff responsible for the care of photographic materials be knowledgeable not only about photographic materials and processes, but also about the appropriate preservation requirements of such collections. The lifespan of photographs can be enhanced by the proper care as described above, and training users and staff would contribute greatly to the longevity of these items. While books and manuscripts present some mental or conceptual indication of the past, photographs give visual form to the past, thereby enriching our understanding of our heritage. For this reason, it is important to preserve this visual aspect of our heritage and to ensure that it remains accessible to future generations.

Although the availability of digital technology has put many photographic collections under the spotlight, it offers many advantages as a preservation method. Digitisation does indeed offer immense preservation possibilities for historic photographs, as both photographs and their negatives can be scanned and used for research and display. However it remains important to note that digitisation does not replace preservation, as original images have to be retained and preserved as heritage objects. Digitisation holds the advantage of enhanced accessibility and mobility, while original images are protected from unnecessary handling and expose to the damaging effect of light, UV, pollutants in the atmosphere and changes in temperature and humidity.

Digitisation should hence not be seen as a threat to the continued existence of photographic materials held in archival collections. Digitisation of photographic records held in archives offer the opportunity to create a form of 'back-up' of collections which are already endangered through their own chemical deterioration, or which were donated in an already fragile state. These records, which can, at times, be too fragile for use, are made available and are accessible for research, display and use. However, it is important to understand that the digital copy is not a replacement of the original, which should still be preserved as best one can. While digital versions of photographic records require their own preservation programme, the advantages are immense. A drawback of digitisation is, however, the multitude of unresolved questions raised regarding copyright, ownership and intellectual property.

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Endnotes

1. This paper is a reworked version of an essay submitted in 2006 as part of the requirements of the Preservation and Conservation course offered in the Postgraduate Diploma in Records and Archives Management, School of Social Sciences, at the University of KwaZulu-Natal, Pietermaritzburg campus. The course was conducted by Prof Patrick Ngulube.
2. There are specific procedures and methods to follow when cleaning photographs. Damaged photographic materials should be set aside for treatment by a professional conservator.
3. The National Archives of Australia (1999) identifies the main types of black and white hotographs largely as: Daguerrotypes (1939–ca18600; Ambrotypes (1851–c1880s); Tintypes, Ferrotypes and Melainotypes (18654–c1930s); Opaltypes (c1890s) Platinotypes (1880–c1930); Cyanotypes c1885–c1910); Albumen printing out papers (1850–c1890;) Collondion printing out papers (1880 – c1910); and Gelatine developing out papers (1880–).

4. For the purpose of this article, unless otherwise indicated, 'photographic records' and 'photographs' refer to analogue and not digital photographs.
5. Silver bromide, Silver chloride and silver idiodide are used according to Eaton (1970:85).
6. The *camera obscura* was also used by astronomers (Scharf 1974: 19) and Leonardo da Vinci referred in his writings to the "dark chamber" (Time Life 1981:136).
7. This device was patented in 1807 by William Hyde Wollaston (Osborne 1979: 193–194).
8. In 1827 Niepce took an almost eight hour long exposure of a courtyard scene on his farm using a pewter sheet coated with bitumen thereby creating the first photograph (Time Life 1981:136–137).
9. According to Bereijo (2004: 324) the ignition temperature of safety film is between about 426°C and 537°C as opposed to the 137°C of acetate nitrate film.
10. Digital technology is rapidly replacing the need for conventional type photographic film.
11. The Autochrome image was invented at the close of the nineteenth century by the Lumière brothers. They used glass plates with black and white emulsions which were "coated with minute particles of dyed potato starch" and which, after processing, produced a coloured positive transparency (Time Life 1981: 42).
12. Also known as polyethylene terephtalate or PET (Bereijo 2004: 324).
13. Fischer (2004: 1) states that later film, bearing a coating on both sides, does not curl.
14. The notch was intended to indicate the emulsion side of the film in the dark.
15. Clippings of film can be tested by placing them in trichloroethylene. Acetate and mylar/polyester clippings will float whereas nitrate clippings will sink (Fischer 2004: 3).
16. Such high temperatures often occur in various areas within Southern Africa. Archives in these areas, which do house nitrate film, should take extra precautions.
17. Ozone occurs naturally in the atmosphere but can be formed when nitrogen oxide and sunlight merge (Roosa and Fellow 1992:4).
18. This term was used at a paper conservation workshop conducted in Cape Town by Johann Maree and Keith Seaford, during

November–December 2005, to describe the damaging gases emitted by plastics and a variety of chemicals and paints, which are detrimental to archival collections. Roosa and Fellow (1992) also use this term to describe the same process.

19. The scope of this article does not allow for any detailed discussion of the different types of, and materials for, photographic enclosures prescribed for the different kinds of photographic materials. The IFLA Core Programme, available at http://palimsest.stanford.edu/byauth/roosa1.html provides clear descriptions.

20. According to Joanne Wilson, conservator at the KwaZulu-Natal Museum Services, photographic enclosures should be slightly acid to prevent acid migration from the photograph to the enclosure, which is equally damaging.

21. PAT tests for harmful chemicals in an enclosure which can cause fading of the images, as well as for the staining reaction between the enclosure and the gelatine.

22. Lecture notes 5/09/2006, University of KwaZulu-Natal, Pietermaritzburg.