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# Conservation of Printed Textiles: to Preserve what is Established

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***Abstract:***
*Printed textiles form a long-standing tradition in Indian textile history. The museums like Victoria Albert Museum in London, Crafts Museum, National Museum in Delhi, Indian Museum in Kolkata, Calico Museum in Ahmedabad, to name few, are the repositories of these heritage articles. There are various old and fragile printed textiles in various museums all over the world that requires immediate attention in term of cleaning and preservation for our future generations. They are a knowledge reservoir for students of textiles, conservation, art historians and art enthusiasts. Therefore it is necessary to conserve these artifacts through various processes of mechanical cleaning that increases the life expectancy of textile objects. This review paper is an attempt to study various methods and techniques that are used in conservation of printed textiles. The aim of the review paper was to document the various available resources to further efforts in research and development in conserving printed textiles.*

***Keywords:*** *Conservation, printed, textile, cleaning, support, preservation, storage, museums*

**1. Printed textiles in Museums**

The long-standing *'patrimoine inmaterial'* of India constitute the heritage of printed textiles. Heritage denoting, knowledge, the nature or use of which has been transmitted from generation to generation and more importantly of interest to us is the nature of this heritage being sustainable and everlasting. In consequence, we find these symbols of culture in our museums.

Printed textiles can be defined as those textiles, which are plain woven and therefore imprinted with hand blocks to create a surface pattern or design on a textile. The definition at this point only constitutes natural textiles and hand block printing since the discussion will be in context of old textiles displayed or stored in the museums.

In India museums are more of classic types, basically custodians of collections. The collections are of country itself to an extent of close neighbourhood because of rich indigenous heritage that it has. The quantity of the antiquities everywhere in this country is so great that the museums of India are now studied and interpreted all around the world. The collections are renowned worldwide for museums like Calico Museum of Textiles in Ahmedabad, Salarjung Museum in Hyderabad, National Museum & Crafts Museum in New Delhi, Indian Museum in Kolkata and many more. Of all the classes of antiquities, textile becomes a major part of collection for most of the museums. It is the largest and most important class of Indian art manufactures. The textile antiquities collected from all over the countries mainly include costumes, head gears, *dupattas*, *odhanis*, jewelry etc. Amongst all the textile classes printed textiles become rather very important class of art industries especially in 18$^{th}$ and 19$^{th}$ century and forma a major part of collection in Indian museums.

There are many examples of printed textiles in various private or government collections that are exquisite and noteworthy. National Museum of India has numerous examples of printed textiles in its display as well as storage. One such example is a displayed 'Qanat'- tent hanging from 18$^{th}$ century. There is a single panel partially printed and partially painted exquisite floral design. The provenance of the object is Rajasthan. Victoria & Albert Museum holds the national collection of textiles which spans a period of more than 5000years. Almost all the techniques of creating and decorating textiles are stored and exhibited in house. Amongst these are the exquisite printed textiles from India like Calicoes, Pintadoes and Chintz. For instance Bequeathed by Sir Michael Sadler is a length of printed cotton fabric whose provenance is probably Deccan. The length has diapered floral sprigs in green and yellow with an outline in red.[1]The copper Hewitt Museum and The Smithsonian Institution's National Museum of Design collaborated to create a collection of printed textiles of the 1760-1860. The aim was to create a platform of knowledge and education for the students of design.[2]The

[1]http://collections.vam.ac.uk/item/O455712/length-of-printed-unknown/
[2]http://www.cooperhewitt.org/publications/printed-textiles-1760-1860-collection-cooper-hewitt-museum

British Museum started a project to collect the printed textiles known as Kanga from Eastern and Southern Africa. The aim of the project was to study the history, development and cultural significance of the printed textiles.[3]

**2. Conserving Museum Textiles: Some Issues**

Conservation professionals, students, researchers and enthusiasts face multifold of issues. Conservation in itself is a complex decision making process that requires meticulous understanding on the background of objects and the final result that is anticipated. Some major issues to be addressed before deciding the kind of conservation treatment required are discussed below;

*2.1. Ageing*

Ageing can be defined as a slow and natural process of degradation of textiles in terms of strength, texture, feel, and physical appearance. The textile becomes fragile and weak. Ageing cannot be ruled out for any object or living organism but it can be delayed for objects like textile. It is also important to delay the ageing of textiles in museums as they are of huge importance to the country and its people. The ageing of the textiles can be delayed by preventive and curative conservation through right display techniques, proper storage facilities as well as through appropriate cleaning of textiles. The ageing is mainly due to the change of temperature along with effects of humidity, light and gases present in the environment and their constant interaction with the organic material.

Textiles like all other organic compounds are made of carbon compounds which when break into smaller parts, causes the loss of strength, elasticity, plasticity and other physical properties of textiles and drastic changes in the physical appearance. The speed of degradation depends on the speed of breaking carbon compound that form the basis of textiles. Dimensional stability of the textiles is greatly altered in the presence of light, humidity, and other gases in the atmosphere, heat and substances like acids or alkalis. The strength of the fibers and their resistance to ageing can be directly proportional to the length and compactness of the molecular chains of which they are made. When the fiber deteriorates the internal bonds of the molecules break, making these chains shorter and thus eventually leading to weakness, even to the breaking of yarn. Any process that compromises the structural integrity of the fiber bonds will cause the degradation of the textile object.

In controlled experiments, we can study one single factor and its effect on textile but in natural environment the single factor theory does not work as all the above-mentioned factors work simultaneously to degrade the textile. Therefore it becomes utmost important to study the textile behavior in context of its environment and also to find a method that best suits the problem. In museums mechanical attack and biological attack are also very often to find.

Before we try to solve the issue of conservation there are few points to be kept in mind regarding the degradation of textiles. The history of textile in its manufacture, usage and environment affects the treatment to be followed in conservations. For example the most common and obvious example can be the use of starch on warp yarns of cotton before the loom operations are started. The starch helps to keep the yarn stiff and straight and thus helps in the better weaving operations. Now, the old textile will be having the residual starch on the warp yarns which will alter the treatment method in comparisons to those fabrics which do not have starch treatment. Also considering the degradation, starch might accelerate the degradation process. It will attract more pests and other kind of biological attack on the object.

The structure and properties of historic textiles would be expected to vary considerably as the exposure to different kind of ageing would be unique and different for each textile. Hence the natural ageing process becomes so complex and the treatments therefore vary considerable with each object. For most of the textiles soiling aggravates the problem of ageing hence wet cleaning of textiles become a trade-off for reducing the deterioration. Removal of soil and wet treatment cause the removal of stiffness, hardness and viscoelastic relaxation. There is less polymer chain scission, fiber deformation and fracture during handling.

*2.2 Fading of Dyed or Printed Textiles*

There is a normal tendency of dyed and printed textiles to fade. It is often spoken of to not put the clothes out in sun as they will fade. It is because sun also acts as a biggest natural bleaching agent. Also use of sun to bleach the textile is the preliminary process in traditional printing. The grey fabric after being washed is put in the sun to dry as well bleach for 2-3 days minimum. The coloured textiles however fade when exposed to light whether natural or artificial. In museums lots of textiles displayed in the lights fade due to overlong exposure. The heat, atmospheric pollution and imbalanced pH could also aggravate the process of fading. Fading is the complex process, some wavelengths being more destructive than the others, the most dangerous being ultraviolet light. Relative humidity also has an effect on the stability of the dyes, colours fading more rapidly in damp conditions.

Fading on cotton & linens that is mainly cellulosic happens through oxidation process. The presence of air is a pre requisite. On proteinaceous fibers such as wool and silk the fading is a much more complex process but mainly occurs through reduction. Wool also yellows on long exposure to light.

Many printed cottons and tapestries, which had the design outlined in black or brown, now have nothing but holes to show where the colour has been, partly because of the iron but also because of the destructive energy of absorbed light (Landi 1998).

Factors that affect fading in historic textiles can be determined by the history of the textiles. Few factors that can aggravate fading are listed below:

- Old historic textiles from India mainly used natural or vegetable dyes. The dyes otherwise not fast could only be bound to the textile through mordants. So all the ancient textiles are mordant dyed and therefore most of them have the problem of fading.

[3]https://www.britishmuseum.org/research/research_projects/complete_projects/kanga_and_printed_textiles.aspx

Different mordants have different fading effects on textiles. A tin-mordanted natural dye can fade around three times faster in light than the same dyes with iron salts.

- Manufacturing conditions of the dye and textile could also affect fading.
- Dye concentration and particle size would also affect the individual fading characteristics of a textile.
- The fading is also dependent on the other substances present in the dye solution or whether it has been used as a dye or a pigment in printing and dyeing.

The conditions in which fading may occur for museum textile objects may therefore differ in different situation. Some objects may just needed to be taken out of the light exposure while others might also need removal of air. For example, in 1811 Prussian Blue dye was discovered. In 1837 a French chemist Chevreul found out that these dyes have extreme colour change in oxygen free conditions. That is the dye faded in reduced atmosphere. While when the same coloured cloth was kept in the well-lit and aired atmosphere it did not fade.

The two basic issues of historic textiles have been discussed in the previous section i.e. Ageing and Fading (specially for dyed and printed textile). Ageing is something that happens for almost every object in the museum, effects being faster on some like textiles while lesser on objects like stone. While fading merely constitutes the textile objects and those, which are, coloured either by block printing or dyeing or painting. The colouring substance being different in all the three forms of coloured textiles.

Further aim after understanding the problems of textiles is to minimize the deterioration. It is been said to reduce and not eradicate because it is not possible to stop ageing, fading to some extent yet not completely. This concept of preserving the textiles to maintain the cultural identity is known as conservation. In conservation the aim is to achieve the best possible results to save the art of museum and to sustain the preservation tactics to the best possible manner without compromising on the ethics of conservation.

**3. Ethics in Conservation**

In conservation there is rarely a perfect answer, all the practices are merely a compromise. It is in the interest of continuation of the object that conservation begins. But mere longevity of the object is not the only aim. The aesthetics of the object, the originality and the meaning associated with the object should all remain intact. In order to save the structure of the material, which is more meaningful to the art historian, the aesthetics of the object should not be lost. There long standing argument between the traditionalists or purists that only natural substances, adhesives or cleaning agents must be used while there is the other group who make use of not only natural materials but also of the adhesives, linings, detergents and solvents which are made in the laboratory for a specific purpose and give predictable results.

In the whole argument of what material to use and what procedure to follow is conserving the textiles the main aim is to achieve the longevity of the object. The truth however cannot be denied, as it is not only possible but relatively important aspect that whether how long the textile survives cannot be guessed. There have been times when 1500 to 2000 years old textiles have survived while there are other textiles like silks of recent centuries which would not last for few years from now. Last but not the least which is a common understanding of the conservation practice that no one method should be irreversible in conservation. All the methods used must be and should be reversed back if required.

Whether the use of a patch of new replica of block print missing on the fabric would affect the structural strength of the fabric while it is maintaining the aesthetics of the object or else completing the meaning symbolically. Whether the use of synthetic paint to finish the lines of prints faded away affect the originality of the textiles? Or whether the wet cleaning of wet textiles is the right approach for the three colour printed textiles? Has it been thoroughly examined for colour-fastness? Will the wet method weaken the fibers?

All the answers to some extent can be meaningless until there is sufficient number of evidences for a particular case to form a background for discussion. The next session deals in particular with the conservation practices that can be followed for printed textiles in general. While it cannot be said if all the practices can be used on all kinds of printed textiles of museums but it can give a background for dealing with certain problem with a probable solution.

**4. Preventive & Curative Conservation**

Exemplary printed textile, such mentioned above have been in the museums all over the world. Most of these impeccable pieces of art in museums are degrading every day because of the perishable nature of the organic textiles of past. Reasons for such degradation are many such as little awareness on how to conserve. Important task ahead of us is to preserve the textiles and conserve the impaired or spoiled textiles.

A textile object in a museum is old and fragile. The fibers do not have the strength of newly made fabric. The colours are faded and threads of surface ornamentation are weak or absent at many places. While dealing with the textiles of such complexity it is of utmost important to deal in a most patient and aware manner, keeping in mind the aesthetics and the sustainability of the object.

At the core of all conservation lies the objects, and respect for the integrity of the object is of paramount importance if its value as evidence of social or technical history, or even its own unique beauty is to be maintained (Landi 1998). When the textile becomes of value and importance to the society it becomes a valuable part of a museum. It is the part of museum and responsibility of the conservators to propagate the right practices.

*4.1. Examination*

It is preliminary to conservation, a process of familiarizing to the integrity of the structure. Here the examiner by observation is able to analyze the object and speculate the kind of handling it may stand. This is a very important step in conservation as it will help in all the decision made in the future.

What to ask while examining;

1. What is the object? Is it a printed garment (costume/drape), a flat piece etc.
2. What is the base material; cotton, silk etc.?
3. What is the material used in surface decoration; what kind of dye has been used? Or what finishing treatments have been applied?
4. What is the general condition of:
   a. Base Material-weave, texture
   b. Design/Print- Is it missing? Is there a specific colour missing? For example, Darker shades usually go missing. Iron mordant accelerates degradation.
   c. Colours- Faded/Blotched?
5. What kind of repair or alteration is suggested?
6. Has there been any alteration in the past?
7. Is the textile spoiled/dirty?
8. Which colour of the textile requires more attention?

A knowledge of the date of an object and the circumstances under which it has been found and kept will help to decide its place and importance in the historical sense, because it is by this knowledge that the conservator will be guided regarding the possible reaction of the fibres, dyes, finishing treatments and construction technique to any available method of cleaning and other conservation treatment. (Finch)

*4.2. Decision Making*

In broader terms two basic problems that needed to be handled in the conservation of objects especially textiles. One is the cleaning of the textiles as most of the textiles accumulate dirt over a period of time in storage as well as display. Why to clean the textiles? Firstly it will enhance the aesthetics of the object and secondly and more functionally dirt or spoil aggravate the degradation process. Second is the support of the object due to weakening of the threads or yarns. Also support is sometimes required while displaying object. Hanging the object directly might hamper the whole idea of conserving textiles. Many textile require support when displayed, it can be either mounting on board or for costumes like cushioning the hangar so that there is no pressure on shoulders of the garment and many more.

These two situations occur while the object has to be displayed. The objects of the museum nearly spent their life in the storage while they are displayed only for few months. Therefore conservation practices are a must while the object has been stored.

It is important to note that not all the time can the object be restored. There are times when the condition of the object is such that nothing can be done. At those times proper recording of the condition as well as a photographic replication can help maintain the objects presence.

*4.3. Cleaning*

The objects are acquired through various places. Most of the objects are personal collections of people, used, spoilt and stained at places.

The importance of an object from the historian's point of view will weigh in making decisions about the desirability of removing any stains and old repairs or alterations. These may be part of the history of the piece and if so should not be removed, even though they distract from the appearance from an aesthetic point of view (Finch).

4.3.1. Mechanical Surface Cleaning

Equipments like vacuum cleaners are used to remove loose surface dirt and dust from the textile. Mechanical cleaning must be done when utmost required. All vacuum cleaners must have their suction reduced to minimum when used on museum textiles. A seed controlled can be used while vacuuming and screens can also be used on top of the object to avoid any surface ornamentation to be sucked.

4.3.2. Wet Cleaning

There are three types of wet cleaning operations

1. Spot Cleaning is the treatment of local stains, which is a limited form of wet or solvent cleaning.

Issues: Some of the stains and deposits are easily identifiable, while the others are not. One brown discoloured stain on 200-year-old textiles is impossible to identify. Therefore the best solution to this problem is trial and error experiments before actually trying it on the real object.

| Group | Solvent |
|---|---|
| I | Deionized water, detergent, ammonia, hydrogen peroxide, enzyme, rust killer |
| II | The alcohols: IMS, methanol, ethanol, phenyl methanol |
| III | The ketone: propanone (acetone) |
| IV | Hydrocarbons: White spirit |

*Table 1*

The following groups can be mixed together to get results according to the problem. However, it is advisable to first try the one which is most probable to give the result and if not, then systematically combine the reagents to follow.

2. Aqueous cleaning or washing is the most effective way of cleaning textiles. The action of water supported by the suitable wetting agents helps to swell the fiber and give up dirt particles easily. It is the best agent to correct pH.

Most of the time the water itself is a cleansing agent without addition of any detergent. The water must not contain any mineral deposits.

For instance a bad brown stain on the Indian palampore was permanently fixed with the use of Tap water. Tap water has lot of active substances that must have helped in the cleaning of the staining. Later the object was thoroughly cleaned in de-ionized water. It is very important to clean the object in de-ionized water so the active particles do not stay in the fabric.

Detergents can be used for cleaning. For an alkaline medium, cellulosics are best suited rest of the objects must be cleaned in no-ionic detergents only.The stock mixture must have the ratio of 10:1 where water has ten parts and detergent has one part.

Issues: Water can move dyes which have not been properly set or attack dressings and dimensional changes can occur if the two textiles are joined.

3. Solvent Cleaning is a safer option as the solvent only dissolves the dirt and does not have affected the fibers. This method of cleaning is quiet under discussion for few years. Thought it is an effective way of cleaning but it is not effective for large textile objects. There is lot of wastage of solvent. There are views on using detergents and small percentages of water which will greatly improve the cleaning power of the solvent.

Issues: The effect of solvent on the dyes is not clearly known.

4.3.3. Recommendations for Cleaning Printed Textiles

All the printed textiles, which are in two dimensions, should be cleaned on flat surface only. The flat surface must remain horizontal at all times of cleaning except when water is to be drained. Before putting the object on the flat surface of water it is important to put a sheet of Melinex. This is important as it will help to remove the textile for drying, after washing. The textile is then covered with a thin Nylon tulle or net to avoid any direct contact of the object with the brush. The water is poured into the flat surface and allowed to wait for ten minutes. The first water supply is drained out carefully without pressing anything on the textiles. Most of the superficial dirt is lost at this stage. The second water supply is accompanied with detergent and based on the situation or condition of textile little agitation is used. The water used is completely de-ionized at all the times. The water is drained out and any detergent is not left which may be very harmful for the object. The sandwiched textile is removed from the flat surface and taken out to be dried. Drying is very important as the textile could not be allowed to stay wet for long. If the atmosphere is cold than fan heaters at the minimum heat can be used. The fan must be moved frequently to avoid uneven drying. Slightly fugitive dyes, having avoided during colour testing and washing, may start to creep along the yarn closest to them when the yarn is half dry.

*4.4. Support*

The term 'support' implies the introduction of a layer of material to which the original object is attached. The aim is to give enough strength to an object to withstand in comparative safety the condition of storage or display prevailing at the time. The conditions can vary from place to place. If it is for study collection then it should be able to withstand the handling. If it has to be in a permanent glass display then less attention required than the object to be placed in the open conditions of a house or gallery. For flat textiles mounting and support can sometimes be considered as support.

4.4.1 Recommendations of Support for Printed Textiles

The printed textiles are single sided so a solid support is possible without loss of information. The support can be of cotton through adhesive. Glazed cottons that become brittle can be supported by reinforced film and stitching should be avoided.

The common problem in printed good is how to make a repeat pattern when the object has vanished and few pieces of prints has been left. The pieces are often distorted and may not be from the same loom as well. Overlapping may be done for the pieces but mostly same kind of piece is usually missing from each section of pattern.

Printed objects, like batik, which are double sided present more of a problem. Local damage can be fixed through darning but this requires the rest of the fabric to be strong at other places otherwise piercing of the needles can further damage the fabric.

Overall weakness, often caused by a dye or mordant used in the pattern needs overall support with adhesive treated net. Areas of pattern that are missing then can be completed by dyeing the pattern on the net.

*4.5. Storage*

4.5.1. General Protective Measures

The main problems for the textile objects arise from light, dust, damp, insects and unnecessary human beings. Light can be excluded from the storage cupboards and boxes easily. The cupboards must be checked for any cracks that may allow dust to enter. Ventilation and humidity of the storage rooms must be controlled. Regular checks must be made and any damping must be solved.

In climates such as in India it is very difficult to manage the pests. The most common pests are clothes moth and carpet beetle that can damage the textile severely. Silver fish and woodworm can also do incidental damage. The best method to prevent insect infestation is the regular checkup and good house-keeping.

4.5.2. Recommendations for Printed Textiles (Head)

The objects can be stored flat, rolled or folded. The rolled storage must ensure enough space for the roller as well as the textiles store but not enough to encourage piling of second layer on top of first.

Very small objects of archaeological findings can be stored in individual enveloped of cellulose acetate sheeting.

When folding large flat textiles always provide padding along the line of each fold to prevent the formation of creases. Sausages can be made from tissue paper.

Objects that have been supported by the adhesive should not be folded in both directions.

**5. Conclusion**

Even though there has been tremendous work been carried out in the field of conservation but still there many territories unexplored. There is very less work being done on the conservation of printed textiles. The reasons have mostly been the fugitive dye colours and or complex structure of fibers due to use of mordants, gums and wax residues in the fabrics. This opens the scope of research and development in the field of cleaning, storing and preserving the printed textiles.

Printed textiles form a very important part of the textiles of museums in Indian and abroad. It is therefore important for the conservators and the students of textiles to find appropriate ways of preserving the heritage without and negative impact on the textiles. The textile objects are not just the treasure of the country and its people but a source of information for academic population of historians, textile students, conservators, curators, connoisseurs of art objects.

There various issues while preserving the textiles as the action to be taken on the textiles must be ethical and best fit the situation in terms of protecting the aesthetics and originality while also sustaining the object. There are views of purists in conservation of the use of only natural products and methods on conservation and while there are others who are open to use suitable synthetic materials as long as they are protecting the textiles. But in all the conservation practices lies the object itself of utmost priority. Sometimes the object cannot be restored at all and must be preserved best in the position it is.

Therefore in conclusion we can say before any process of conservation is acted upon the object, all the possible methods of conservation must be pondered upon and tested. For example, the dyed and printed textiles must be colour tested before wet cleaning. The ethics of conservation must not be violated and most importantly it must be understood that all the conservation methods are a compromise as full restoration of the object to its originality is practically impossible.

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